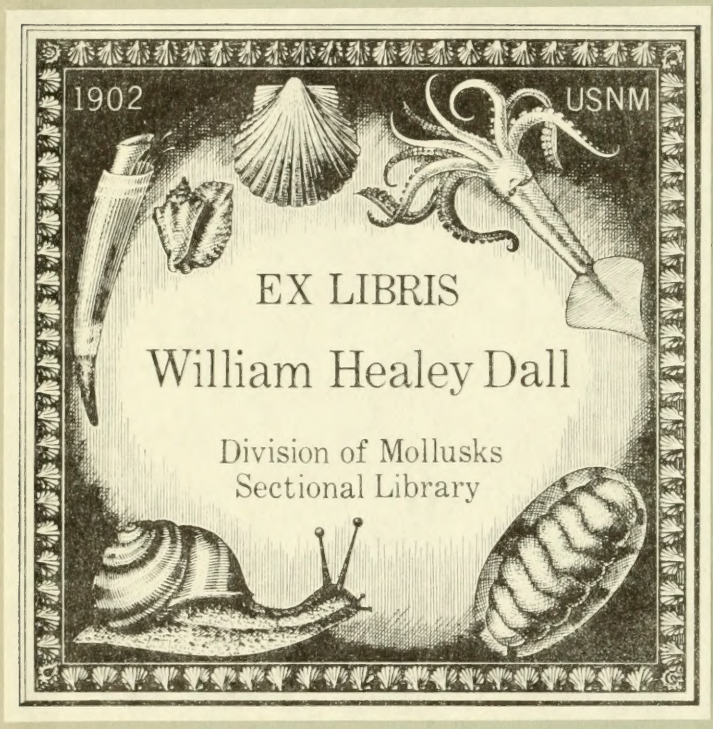
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K-E-C. TAYLOR

MONOGRAPH
OF THE
LAND & FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

JOHN W. TAYLOR, M.Sc.

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NOTICE.

THE great depletion of our trained and experienced staff by the voluntary and forcible enlistment of our men to carry on the present unhappy war, has militated against the issue of the present Part; and it is feared that as there are still few or no apparent signs of an early peace, the calls for more and more men for war purposes will become still more severe and insistent, and business be still further injured; every effort, however, will be made to secure the publication of **Part XXIII.** at the earliest possible date.

At the wish of many Subscribers, the Plates will not in future be pasted in, but will be loose, so that they can be readily inserted in their proper position by the Binder, without risk of injury.

Great care should, therefore, be taken of them, as they cannot be replaced, and their presence in every Part sent out is assured by double checking.

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Mollusks

MONOGRAPH
OF THE
LAND AND FRESHWATER MOLLUSCA
OF THE
BRITISH ISLES.

Phylum MOLLUSCA Cuvier.
Class GASTROPODA Cuvier.
Sub-Class *ANISOPLEURA* Lankester
Order EUTHYNEURA Lankester.
Sub-Order *STYLOMMATOPHORA* A. Schmidt.
Family HELICIDÆ Linné.
Genus *HYGROMIA* Risso.

(Trichia, Hartmann; Fruticicola, Held; Capillaria, Honigmann; Bradybæna, Beck).

Antoine Risso.

THE term *Hygromia* (ὑγρός, moist or damp) aptly designates the present genus, which is especially characteristic of the Western Palæarctic region, and, as is clearly indicated by the character of their shells, are typically shade-loving or woodland species.

This mode of life induces a feeble calcification of the shell with a consequent diminution or even atrophy of the apertural rib and the development of a dull and thick epidermis with a tendency to become closely beset with numerous projecting hairs or bristles, all peculiarities characteristic of a moist and umbrageous environment.

Occasionally the shells bear a somewhat opaque white peripheral zone, an atavic evidence of some former scheme of ornamentation, and that this peculiarity is vestigial is rendered probable by the retention of this calcified zone and perceptible remnants of the concomitant spiral banding by many species belonging to very diverse genera, a circumstance which indubitably points to their community of descent from some ancestral banded form, it being quite improbable that such a number of species belonging to so many distinct groups should simultaneously evolve nascent banding so exactly uniform in character and position.

A section, under the name *Leucozonæ*, was established by Dr. Westerlund to emphasize this character.

The group was established by Prof. Antoine Risso, of Nice, the celebrated Italian naturalist, with whom the genus is here associated.

INTERNALLY, the ANIMAL displays the same general arrangements of organic structure as the typical *Helices*, a relationship shown also by the disposition of the retractor muscle of the right tentacle, which passes in its course between the male and female organs, this entanglement being indicative of a fundamental unity of plan, probably dating far back in the history of the group, and differentiating it from the genus *Helicella* and its allies.

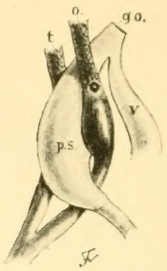


FIG. 2.—Terminal portion of the right tentacular retractors in *Helix*, showing their entanglement with the Reproductive organs, × 3.

g.o. genital orifice; *o.* retractor of right ommatophore; *p.s.* penis-sheath; *t.* lower tentacular retractors; *v.* vagina.

Characteristic features of the genus are the absence of the diverticulum or auxiliary branch of the spermatheca, the frequent doubling of the dart-sacs, or stylophores, the presence of accessory sacs, and the separation of the mucus glands from their close association with the dart sacs by their elevation on the vagina, though some members of the group have lost one or more of these organs by degeneration.

The SHELL is usually somewhat thin, and only slightly calcified, of an uniformly horny or dull brownish colour, and often hispid, all peculiarities distinguishing species affecting a damp and shady habitat; the aperture is slightly expanded and strengthened internally by a submarginal rib, which is most prominent basally, where denticular thickenings are sometimes developed.

The JAW is pycnognathous and crescentic in shape, with numerous slightly divergent riblets on its anterior surface, which faintly denticulate the cutting margin, and are apparently due to overfoldings of the substance of the jaw.

The RADULA, as customary in the *Helicidæ*, possesses numerous teeth, arranged in three longitudinal series, which comprise a median symmetrical tooth, an asymmetrical bidentate lateral group, and a marginal series, which may become tridentate or quadridentate by the splitting of the ectocone of the lateral series.

A close convergence of external characters, due to similarity of habit and mode of life, has led to great confusion and frequent incorrect appreciation of the status of various members referred to this group, and also a lamentable lack of uniformity in their identification between the British and Continental authors, partially ascribable to deficient knowledge of the internal organization of the animals.

I have, therefore, carefully given the names used by the authors themselves for such records as I have ventured to quote, and I hope that the present work will clear up the confusion that still exists on this subject, by giving accurate figures and descriptions of the morphology and organization of the various species found in this country.

Dr. Pilsbry states that the genus as understood by him is not well represented in the fossil state, although certain forms are known as far back as the Oligocene in Central Europe.

Hygromia striolata (C. Pfeiffer).

1678 *Cochlea dilute rufescens aut subalbida sinu ad umbilicum exiguo circinato*, Lister, Anim. Angl., p. 125, pl. ii., f. 12.
1742 *Cochlea terrestris depressa & umbilicata mellei coloris, labio candido repando, sinu ad umbilicum exiguo circinato*, Gualt., Conch., pl. 3, f. m.

1778 *Cochlea rufescens* DaCosta, Brit. Conch., p. 80, pl. iv., f. 6.
1803 *Helix rufescens* Mont., Test. Brit., ii., p. 420, pl. 25, f. 2.
1813 — *altenana* Gärtn., Syst. d. Wett., p. 27.
1820 — *montana, circinata*, and *cælata* Studer, Syst. Verz., p. 12.
1828 — **striolata** C. Pfeiffer, Naturg., iii., p. 28, pl. 6, f. 8.
1841 — *rufina* Parreyss in L. Pfeiffer, Symb., i., p. 39.
1842 — *parreyssii* Fitz. in L. Pfeiffer, Symb., ii., p. 93.
1842 — *tomentosa* Adams in L. Pfeiffer, Symb., ii., p. 105.
1855 — *Helix* (*Zenobia*) *rufescens* Moq.-Tan., Hist. Moll., ii., p. 236, pl. xvi., ff. 18, 19.
1837 *Bradybæna rufescens, cælata*, and *circinata* Beck, Ind. Moll., p. 21.
1837 *Fruticicola circinata* Held, Isis, p. 914.
1852 *Teba rufescens* Leach, Syn., p. 70.
1858 **Hygromia** *rufescens* Adams, Genera of Moll., p. 215.

Edgar A. Smith

HISTORY.—This species was first noticed in 1674 by our famous countryman, Dr. Martin Lister, who applied to it the cumbrous polynomial designations usual at that period. In 1777 Pennant applied the name of *Helix rufescens* to what he erroneously believed was Lister's species, and this name was universally adopted.

Though this species has been considered as identical with *Helix glabella* of Draparnaud, I am unable, judging from the original description and figure, to accept that view, and it is certainly not the *Helix glabella* of Moquin-Tandon if his figure and description of its organs are reliable.

Herr Clessin refers to this species *Helix phorochæta* of Bourguignat and the *Helix submontana* of Mabille, and it is also considered to be in part the *Helix turtorum* of Gmelin.

Dupuy on p. 195 of his great work by oversight refers *H. subrufescens* Miller to this species, while at p. 180 he correctly gives it as a synonym of *H. fusca*.

Mr. Edgar A. Smith, I.S.O., to whom we have pleasure in dedicating this species, not only as an appreciation of his great and continuous services to conchology generally, but also because it is to him we are indebted for conclusively showing from an examination of Pennant's type of *Helix rufescens* that it is not the species to which that name has been so long applied, but is an immature stage of *Helicigona arbustorum*.

FIG. 4.—*H. rufescens* Pennant (after Pennant).

In 1905 I had the opportunity of myself examining Pennant's Zoology, and then noted the improbability of his figure representing the *Hygromia rufescens* of authors, and remarked that the figure rather recalled an immature *Helix aspersa*.

After careful investigation, I have adopted the name *Helix striolata* of C. Pfeiffer for this species as the oldest which can be satisfactorily determined by the original evidence. All anterior names—*altenana*, *montana*, *circinata*, *glabella*, etc.—are subject to the gravest objections by the various authors who have treated of the species and differently apply the names.

Diagnosis.—The differences of *Hygromia striolata* from the closely-allied *H. hispida* are really more testaceological than anatomical.

The SHELL differs in its larger size, less compact and more depressed shape, and the absence of epidermal hairs in the adult. The whorls are also usually angulate at the periphery, especially in the immature stage.

INTERNALLY, the REPRODUCTIVE SYSTEM has not yet been shown to offer any constant difference from that of *H. hispida*, but the mandible in the specimens examined shows fewer riblets, while the teeth of the radula are noticeably laterally compressed and more elongate than in that species.

Description of Animal.—The ANIMAL, though very variable in its pigmentation, usually has the BODY of an ashy-grey, and is strongly and closely tuberculate, the summits of the tubercles appearing paler owing to an aggregation of minute whitish specks; the DORSAL GROOVES are well marked and enclose a row of closely-arranged oblong tubercles; the LATERAL GROOVES are also clearly defined; MANTLE greyish. In the less-deeply pigmented animals the tentacular RETRACTORS show through the skin as broad blackish bands, extending from the tentacles along each side of the body. OMMATOPHORES long and not very slender, but finely granulate, with oval tips, eye specks black; lower tentacles very short. FOOT whitish-grey, somewhat short, blunt in front, and obtusely-pointed behind.

Description of Shell.—The SHELL is composed of 6–7 whorls, of a subglobosely depressed shape, perceptibly keeled or angulated at the periphery, which is sometimes encircled by a pale peripheral zone, with an obtusely convex spire and channeled suture, especially in the earlier stages of growth; the COLOUR is usually rufous-brown or a dusky-yellowish with darker shades or mottlings, somewhat irregularly striate, and usually destitute when adult of the periostracal hairs, which are frequently distinctly perceptible in the young stage, and may sometimes persist in the adult; the APEX is glossy, with delicate spiral sculpture. APERTURE obliquely lunate, and inflected; LIP thin, and slightly expanded, with a milk-white submarginal RIB, which is most strongly developed basally, and differs from that of the true or typical *Helices* in being comparatively distant from the mouth margin at the suture, though close to it basally. UMBILICUS distinct and open, but not wide.

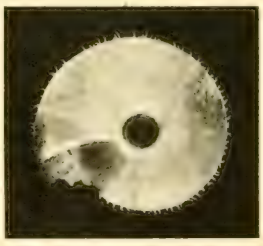


FIG. 5.—Young shell of *H. striolata* × 5, Grange, Mr. F. Booth, showing the hispid epidermis (from photograph by Mr. W. Bagshaw).

Diam. 12 mill.; alt. 7½ mill. Average weight of British adult shells, 1 grain.

The EPIPHRAGM is thin, vitreous, and nearly flush with the aperture of the shell.

INTERNALLY, the NERVE-RING is fairly compact, the central opening small, but the fusion of the VISCERAL GANGLIA is not quite complete, and the position of the pleural centres is frequently shown by faint traces of their demarcation. The paired PEDAL or locomotory ganglia are also compact, and show the OTOCYSTS on the posterior outside corners; the LIVER or digestive gland is of a dark olive-brown colour, and the hepatic artery is of an inconspicuous greyish-white, while the KIDNEY or renal organ is of the usual elongately triangular shape, and of a buff colour with dusky streaks.

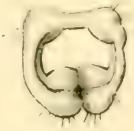


FIG. 6.

FIG. 7.

FIG. 6.—Nerve-ring of *Hygromia striolata*, to show the arrangement of the supra- and sub-œsophageal ganglia, highly magnified.

FIG. 7.—Lower aspect of the subœsophageal ganglia, showing the otocysts, highly magnified.

The MUSCULAR SYSTEM shows a broad undivided muscle to the BUCCAL BULB; the TENTACULAR RETRACTOR divides near the common base of attachment to the columella into two broad muscular straps, the retractors of the right and left tentacles, each of which a little beyond the half-way divide into slips for the upper and lower tentacles of their respective sides, and also each give off a broad slip, which becomes split up into strands to the anterior part of the foot.

FIG. 8.

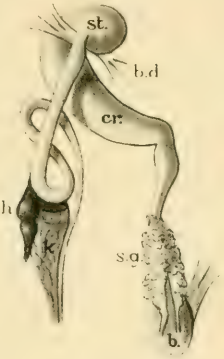


FIG. 9.

FIG. 10.

FIG. 8.—Retractors of *Hygromia striolata*, showing the columellar, the buccal, the tentacular and anterior pedal muscles, highly magnified (after a dissection and drawing by Miss M. V. Lebour).

FIG. 9.—Alimentary system of *Hygromia striolata*, showing also its relationship with the heart and the kidney, × 3.
b. buccal bulb; *b.d.* bile ducts; *cr.* crop; *h.* heart; *k.* kidney; *s.g.* salivary glands; *st.* stomach.

FIG. 10.—Reproductive organs of *Hygromia striolata*, × 3.
a g. albumen gland; *d.s.* dart sacs; *ep.* epiphallus; *fl.* flagellum; *m.gl.* mucus glands; *ot.* ovotestis; *ov.* oviduct; *p.* penis-sheath; *r.* penial retractor; *sp.* spermatheca.

The REPRODUCTIVE ORGANS display an elongate OVOTESTIS, with a much convoluted duct; the VESICULA SEMINALIS or claw is unusually well developed, and shows clearly as a doubled channel, it is lanceolate, and sometimes bilobed at its extremity; the ALBUMEN GLAND narrowly linguiform and amber coloured, palest on the concave face; the PROSTATE or sperm-duct is thick and creamy-buff in colour; and the OVIDUCT has the usual sacculations; the FREE OVIDUCT or vagina gives off the thick, white, and very elongate SPERMATHECA DUCT, the oval terminal VESICLE being of a pinkish-cream or ochreous tint, with anastomosing brown

FIG. 11.

FIG. 12.

FIG. 13.

FIG. 14.

FIG. 11.—Distal part of the reproductive organs of *Hygromia striolata*, showing the natural position of spermatheca and convolutions of hermaphrodite duct (greatly enlarged).

FIG. 12.—Vesicula seminalis or claw of *Hygromia striolata* (greatly enlarged).

FIG. 13.—Bilaterally paired dart sacs and mucus glands of *Hygromia striolata*, × 3.
v. vagina and dart sacs; *v.gl.* vaginal glands; *p.s.* penis sheath.

FIG. 14.—Penis-sheath of *Hygromia striolata*, laid open to show the intromittent organ, × 12.
p. intromittent organ; *p.s.* penis sheath; *r.* retractor; *v.d.* vas deferens.

streaks, and attached to the middle of oviduct. The stout and rigid MUCUS-GLANDS are usually eight in number, and arranged in pairs; they are about 3 mill. long, somewhat irregularly digitate, with usually a noticeable constriction near the centre; they are occasionally bifid and even trifid at the extremities, and show

opaque white or buff cores, while each digitation is joined to the oviduct by a short slender stalk. The PENIS-SHEATH is very stout and white in colour, but distinctly constricted at its junction with the ATRIUM, where it is smeared and spotted with brown; the distal end is continued as a tapering and twisted EPIPHALLUS, to which is affixed a broad RETRACTOR MUSCLE, and the terminal FLAGELLUM is also well developed.

The STYLOPHORES or true dart-sacs are two in number, of a semi-transparent white or yellowish-white colour, finely spotted with brown, and are placed on opposite sides of the vagina, each associated with a smaller, more opaque, and empty superimposed auxiliary sac or lobe of similar external aspect.

FIG. 15.

FIG. 16.

FIG. 15.—Gypsobela or Love-darts of *Hygromia striolata*, × 20.

FIG. 16.—Apex of the Love-dart of *H. striolata*, to show the initiation or incipient formation of the lateral blades (greatly enlarged).

The GYPSOBELA or twin love-darts are more than a millimetre in length, and usually slightly curved, but sometimes are perfectly straight, with a tapering, round and smooth hollow shaft, and a relatively large and expanded base of attachment, which shows obscure traces of an annulus, and also a noticeable tendency to develop a pair of longitudinal blades at the apex.

The ALIMENTARY SYSTEM is on the general Helicidian plan; the SALIVARY GLANDS are long and narrow, of a slaty-grey colour, with darker ducts, but in comparison with *Helix aspersa*, differ in surrounding the middle of the œsophagus, and not clasping the crop; the ŒSOPHAGUS also is longer in proportion, and leads to the voluminous light brown or buff coloured CROP, which, as is usual, merges into the STOMACH, whose position is often displayed by a more pronounced distension, and by the place of entry of the bile ducts; the GUT is of the ordinary triodromous character, but the yellowish-white intestinal flexures contrast strongly with the dark coloured LIVER, and are more distant from the posterior end of the stomach than in that species.

The JAW or mandible is crescentic in shape and of the aulacognathous or pycnognathous type, and amber in colour, bearing on its anterior surface a broad and flat central and vertical rib, which perceptibly projects beyond the general outline, and numerous delicate lateral ribbings which only slightly crenulate the cutting margin; the line of attachment of the mandible to the buccal cavity is shown by the stronger and thicker medial region, which appears as a darker area extending across the mandible parallel to the cutting margin and as a posterior extension.

FIG. 17.—Mandible or Jaw of *H. striolata*, greatly enlarged (from a micro-photograph by Mr. W. Bagshaw).

The RADULA is of the usual oblong form, and in the specimen figured possesses about 104 longitudinal rows of teeth, with a maximum of 67 teeth in a transverse row, each row being constituted by a somewhat long, narrow, and tricuspidate central tooth bearing a long and powerful median cutting-point or mesocone and two insignificant subsidiary cutting-points or ectocones placed far back at the shoulder of the tooth; the laterals are uniformly bidentate and conspicuously larger than the median row; the mesocone also is larger and stronger, the endocone or

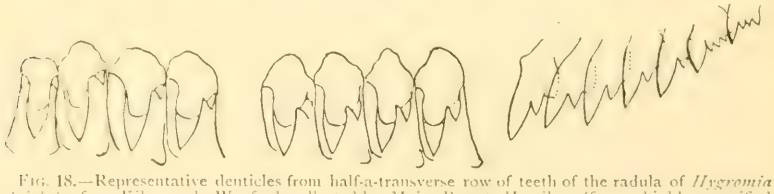


FIG. 18.—Representative denticles from half-a-transverse row of teeth of the radula of *Hygromia striolata*, from Kilmanock, Wexford, collected by Major Barrett-Hamilton (from a highly magnified micro-photograph by Mr. W. Bagshaw of a preparation by Mr. J. W. Neville).

inner cutting-point becomes entirely lost or suppressed, but the ectocone or outer cutting-point is retained and gradually increases in size and strength as the teeth recede from the centre; about the twentieth row the splitting of the ectocone

signalizes the commencement of the marginal series, the teeth diminishing rapidly in size and more or less generally becoming tricuspidate or even occasionally show four cutting points.

The formula of a specimen from Wexford, prepared by Mr. J. W. Neville, is

$$\frac{1.3}{3} + \frac{2.0}{2} + \frac{1}{3} + \frac{2.0}{2} + \frac{1.3}{3} \times 104 = 6{,}968 \text{ teeth.}$$

Reproduction and Development.—No observations have been made of the amatory preludes or the conjugation of this species, but the season probably begins in the early spring, and is continued throughout the summer months, while egg deposition has been actually noted to take place from July to October. The eggs have been described as opalescent-white, and globular in form, about $1\frac{1}{2}$ mill. in diameter, and 40 to 50 in number; they usually hatch in from 20 to 25 days, and attain full growth during the following season.

In July, 1883, the late Mr. Chas. Ashford dissected a specimen in which the oviduct was crowded with eggs, seventeen being counted, occupying the ducts from the albumen gland downwards. The eggs traversing the oviduct were all transparent and colourless, but after passing between the openings of the mucus glands and dart sacs, each egg became enclosed in a white calcareous shell, demonstrating that these organs, so rich in calcic substances, function in forming the hard enveloping shell.

Fig. 19.

Fig. 20.

Fig. 19.—Section through oviduct showing the descent of the eggs after passing the albumen gland (enlarged).

Fig. 20.—Section through the free oviduct showing the passage of the eggs between the dart sacs and digitate glands, the place of acquirement of the calcareous investment of the ova (enlarged).

The young of this species, as stated by Montagu, is frequently covered with short hairs, which are seldom spread over the whole shell. In this hispid immature state it is, according to L. Pfeiffer, the *Helix tomentosa* of Adams. This hispid character, however, becomes lost before the shells are half grown, but their sockets are often perceptible with a good lens, while the nucleus is said to show delicate spiral striation, and Dr. Jeffreys has noted that at Clifden, Galway, shells have been found in which this spiral sculpture is continued on the shells to maturity.

In the autumn months the young shells are more scansorial than in later life, and may often be brought down in showers by beating ivy, etc., growing on old walls and other places.

Before maturity, the animal may construct, from time to time, one or more calcareous submarginal ribs to the aperture, and these premature ribs or thickenings, due to interruptions of growth, frequently persist and are visible through the substance of the shell as broad transverse whitish streaks.

Food and Habits.—The food of this species has not yet been thoroughly and systematically noted, but it is well known as one of the pests of a garden, and its fondness for *Arabis albida*, violet leaves, primroses, and the petals of the cultivated poppies has been recorded, while its predilection for strawberry beds has led to its being called the "strawberry snail"; the underside of the leaves of buttercups (*Ranunculus*) is also a favourite resort and probably of food in certain districts.

Though stated to be especially characteristic of the nettles and brambles on the outskirts of somewhat damp oak-birch woods, it displays by its

abundance a decided preference for chalk or limestone ground, where it is generally plentiful; it is less so on sand, and especially on clay. It is very fond of damp places, osier-beds, and ivy-covered walls or hedges, and is also found plentifully in gardens and in hedge-rows, amongst nettles, etc. On the sea-coast the largest shells often live or are found on bramble and sea-cabbage.

Though usually geophilous in habit, it has been known to ascend trees and hedgerows to a good height, and to remain for hours adherent to the upper twigs, and even to æstivate on the boles of trees fully exposed to the sun's rays. It also tends to inhabit more open country than, judging by its hirsute immature shells, was apparently the case at some former period, and is undergoing modification in adaptation thereto.

It is nocturnal or crepuscular in habit, seldom stirring from its place of concealment during the day, unless in very moist and showery weather, but hiding in the crevices, or crawling beneath stones, heaps of rubbish, etc.

It is a fairly active species, carrying its shell inclined to the right side and towards the front when crawling, and ranges to an altitude of about 4,000 feet in the Alps.

Like *Helix cantiana*, it voids when irritated or roughly handled a quantity of limpid tasteless fluid, but this feature is not so marked a characteristic as in *Helicella virgata* and its allies.

Though *H. striolata* begins to retire for hibernation when the temperature sinks to about 38 deg. Fahrenheit, often as early as October, yet it breaks its hibernation in the damp and milder days of winter, and wanders about and feeds when the temperature reaches 40 deg. Fahrenheit.

The circulation of this species shows considerable power, as at 31 deg. Fahrenheit it shows five or six heart contractions per minute, all very full and deliberate and not weak and feeble as in certain other species.

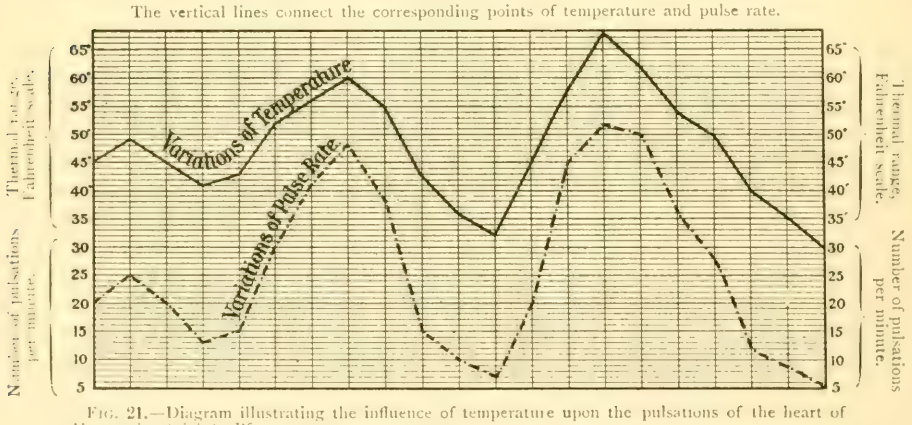


FIG. 21.—Diagram illustrating the influence of temperature upon the pulsations of the heart of *Hygromia striolata* Pfr.

Enemies.—The enemies of this species are those of the land mollusca generally. It is known to be devoured by rats. The thrushes are very fond of it, as is shown by the frequent presence of the broken shells at the thrush-stones; and the crops of the nestlings of the missel thrush (*Turdus viscivorus*), wood pigeon (*Columba palumbus*), and stockdove (*Columba œnas*) have been found to contain or be filled with the shells, while even well fed fowls pick up and eat those creatures with evident pleasure.

HYGROMIA AND HELICODONTA.

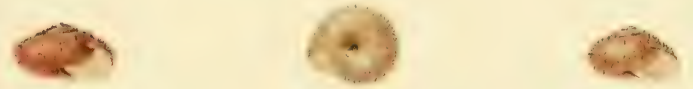
Hygromia striolata (C. Pfeiffer) × 1¼.
Boston Spa, Yorkshire.

H. striolata var. *rubens* (Moq.)×1¼
Boston Spa, Yorks.

H. striolata var. *alba* (Moq.)×1¼.
Bristol, Miss F. M. Hele.

H. striolata var. *albocincta* (Ckll.) ×1¼.
Saundersfoot, Pembroke, F. M. Burton.

Hygromia hispida (Linné) × 2.
Port Bannatyne, Bute, T. Scott.



H. hispida var. *fusca* (Moq.) × 2.
Grimsargh, Lancs., W. H. Heathcote.

H. hispida var. *sericea* (Drap). × 2.
Bavaria, S. Clessin.

Hygromia revelata (Michaud) × 1½.
The Lizard, Cornwall, Miss F. M. Hele.

Hygromia fusca (Montagu) × 1½.
Bassenthwaite, Cumberland, Capt. W. J. Farrer.

Helicodonta obvoluta (Müller) × 1½.
Ditcham Wood, Hampshire, L. Dawes.

Geological Distribution.— *H. striolata* has not been found as yet below the deposits of Pleistocene age, either in the British Isles or elsewhere.

Pleistocene.—In Wiltshire it has been recorded from the brick-earth, Fisherton, by Mr. Blackmore.

In Dorset, it has been recorded from the tufa at Blashenwell, by Mr. J. C. Mansel-Pleydell, and by the Rev. R. A. Bullen from Portland Bill.

In Essex, it has been recorded from the Mammaliferous beds of Grays, as well as from Clacton and Copford by Prof. Morris; from the Palæolithic sand of the Lea Valley by Mr. Worthington G. Smith; and from Harwich on the authority of the late Dr. S. P. Woodward.

In Suffolk, it has been recorded by Prof. Morris from the Mammaliferous beds of Stutton.

In Lancashire, from the upper layers of "cave-earth" at the "Dog-holes," Warton Crag, by Mr. J. Wilfrid Jackson.

In Germany, Herr Clessin records *Helix rufescens* from Bavaria in the Pleistocene tufa of Regensburg, and from the loess of the Danubian valley; Prof. Sandberger from the Lower and Middle Pleistocene deposits at Grötzingen, Baden, and as the var. *montana* from the Lower and Middle Pleistocene sands at Mosbach and Mauer, also the deposits at Oos, Altmalsch, Mühlhausen, Heidelberg and Neckarelz, Baden; in tufa of Lower and Middle Pleistocene age at Cannstadt, Wurtemburg; in the Lower and Middle Pleistocene deposits of Oppenheim, and the Erbenheimer valley, near Wiesbaden in Hesse-Darmstadt, and at Bad Ems, Nassau.

In the Upper Pleistocene, Prof. Sandberger records it from Weimar in Thuringia, the tufa of Cannstadt, Wurtemburg, and in the valley löess at Lommatzsch and Robschutz, Saxony.

In Holland, as *Helix rufescens* var. *montana* it is recorded by Prof. Sandberger from the Lower and Middle Pleistocene of Brommeln near Maestricht.

In Austria, Sandberger also quotes the typical form of *Helix rufescens* from the valley löess of both Lower and Middle Pleistocene age at Nussdorf near Vienna.

Holocene.—It has been found in numerous Holocene deposits in this country, but there are few continental records.

In Somersetshire, it is recorded by Kennard and Woodward from an alluvial deposit at Castle Cary.

In Wilts., it was found in the surface deposits at the great circle at Avebury by Mr. Harold St. George Gray.

In Kent, it was recorded by the Rev. R. Ashington Bullen from a road section under the South Downs, Folkestone, and in a deposit at Barton Court, Dover; Mr. Spurrell found it in a section exposed at the sewer-outfall at Crossness; Kennard and Woodward quote it from the base of an early Romano-British tumulus at Stanley's Quarry, Ightham; and Prof. Morris notes it from loamy sand and pebbles exposed in the excavation for new reservoir at Maidstone.

In Hampshire, it has been found in friable calcareous tufa at Twyford by Mr. Chas. Ashford; and recorded by Mr. J. T. Kemp from tufa near the Southampton Waterworks, in mole-hills in the Anton Valley, and in the valley of the Test.

In Middlesex, Mr. J. E. Cooper detected it in excavations by the Gasworks, Staines; Mr. Loydell in a section by the Thames a mile west of the town; Mr. Greenhill found it in a sandy deposit of probable "Bronze age" at Clapton; and Mr. Davies in the excavations at the Houses of Parliament, Westminster.

In Surrey, it was found by the Rev. R. Ashington Bullen to a depth of four feet from the surface in Colley Pit, Reigate.

In Essex, it was found in alluvium at Felstead by Mr. French; in the deposits on the banks of the river Camm, Chignal St. James, by Mr. Miller Christy; from alluvium at Roxwell, and in a drain-section at Shalford, by the Rev. A. J. Law; from excavations at the Victoria Docks by Mr. Blanford; and from Witham, Braintree, Raine, and Tilbury, by Messrs. Kennard, Woodward, Webb and others.

In Gloucestershire, it is recorded by Messrs. Hinton and Kennard from several of the layers in the King's Beeches Gravel Quarry, Cleeve Hill.

In Yorkshire, it was found abundantly in the alluvium of the Ribble at Mitton Bridge by Mr. J. Wilfrid Jackson.

In Galway, it was discovered by Mr. R. D. Darbishire in the "black earth" band, Dog's Bay, Roundstone.

Variation.—The variation in *H. striolata* is somewhat perplexing owing to its intergrading with *H. hispida* and other closely-allied forms and such intermediate links have in many cases been proposed as distinct species. Dr. Westerlund accepted three British species: *H. striolata*, *H. rufescens*, and *H. abludens*.

The *Helix abludens* Locard, recorded hitherto only from Dublin, Jersey, and Boulogne, and which Dr. Scharff found commonly in his garden at Leeson Park, Dublin, and regarded as a flattened form of *H. striolata* perhaps produced by unhealthy animals.

A large and thick-shelled form from the alluvium of the Danube is recognized by Herr Clessin under the name of var. *alluvians*, but I know of no other description.

In the North-east of Ireland, where it is local and rare, it is said by Irish conchologists to merge almost insensibly into *H. hispida*, which is quite a common species there.

The Rev. Canon Norman has observed that in shady umbrageous places the shells are usually large and horn coloured, while in drier places the shells are smaller, deeper in colour, and with a more elevated spire.

A study of the characters of the shell from the earliest stages would seem to indicate that this species is probably in process of quitting the more shady sheltered and moist stations amongst which—judging by its hirsute juvenile stage—its immediate ancestors lived, and is now gradually assuming the occupancy of more open and drier ground, its food and habits probably not directly conflicting with those of the more dominant true *Helices*.

This change of habit is indicated and attested by the attenuation of the epidermis, the usually total loss of the epidermal hairs in the adult stage, and the greater development of the calcareous basis of the shell.

The white and more calcified peripheral zone is most distinctly and most frequently shown towards the limits of its geographical range, thus implying it to be an ancient characteristic, which is probably on the road to extinction.

The var. *clessini*, in which the hairy investment persists to adult life, shows that the life of this form is still spent within the leafy shades, as in such situations the thicker epidermis and epidermal outgrowths are developed and fostered.

The undescribed varieties *cornea* and *subcornea* of Bouchard-Chantereaux appear to be but very slight subvariations of the typical shells.

VARIATIONS OF FORM OF SHELL.

Var. **danubialis** Clessin.

Helix danubialis Clessin, Jahrb. Deutsh. Mal. Ges., 1874, p. 184, pl. 8.
Fruticicola rufescens var. *montana* Clessin, Deutsche Exc. Moll., 1884, p. 158.

SHELL more compact and with a more elevated spire. Diam., 10–11·5 mill.; alt., 6·5–7 mill.

The sub-var. **montana** seems to differ only in its usually darker colour.

This variety, which is perhaps the mountain variety mentioned by Reeve, is practically synonymous with the *Helix montana* Clessin, etc., is a noticeably tall and compact shell, which Clessin describes as brown, translucent, and finely striate, with a slightly angled and paler periphery. Clessin's illustrative figure is not satisfactory. Diam., 11 mill.; alt., 6½ mill.

FIG. 22.—*Helix danubialis* Clessin × 1½ (after Clessin).

ENGLAND.

York S.W.—Bretton West, Barnsley, April 1910! W. E. Brady.

York Mid W.—One specimen with a remarkably raised spire found at Skipton by Dr. R. F. Scharff, which may be probably allocated here.

CONTINENTAL DISTRIBUTION.

Germany—Abundant in meadows by the river at Ulm, and in the woods of the Danubian valley, Bavaria. The sub-var. *montana* is recorded from Nassau.

France—The sub-var. *montana* is recorded from the Ardennes, Côte d'Or, Hautes Alpes, and Jura.

Switzerland—The sub-var. *montana* is recorded from Neuchâtel and Berne.

Var. **depressa** Taylor.

SHELL with the spire only slightly elevated above the body-whorl. Diam., 10 mill. ; alt., 4 mill.

This variety, which was named but I understand not described by Locard, is stated by Mr. Stubbs to especially frequent heaps of loose stones at Tenby.

ENGLAND AND WALES.

Cornwall W.—Newquay ! J. H. James. Falmouth, June 1911 ! A. P. Gardiner.
Somerset N.—Locking, May 1883 ! J. Madison. Toomer, near Henstridge, E. W. Swanton.
Isle of Wight—Ventnor ! C. Ashford.
Sussex E.—Eastbourne, Aug. 1883 ! Rev. S. Spencer Pearce.
Surrey—Grayswood, E. W. Swanton.
Kent E.—Rochester, Oct. 1908, F. H. Sikes.
Oxford—Adderbury near Banbury, Rev. S. Spencer Pearce.
Norfolk E.—Catton, A. Mayfield. Yelverton, Rev. S. Spencer Pearce.
Pembroke—Wreck-field, Tenby, 1896 ! A. G. Stubbs.
York S.W.—Swithen near Barnsley, May 1909 ! W. E. Brady.
York Mid W.—Ilkley, April 1901 ! T. Castle. Common at Greengates, Saltaire, and Bingley, J. W. Carter.

IRELAND.

Waterford—Near Waterford, April 1911 ! A. W. Stelfox.

Var. **subcarinata** Clessin, Jahrb. Deutsch. Mal. Ges., 1874, p. 181, pl. 8, f. 6.

SHELL much depressed, with a sharply angulated periphery.

This variety is, according to Clessin, probably the *Helix parreyssi* of Fitzinger, which is described by L. Pfeiffer as possessing a more distinct keel.

CONTINENTAL DISTRIBUTION.

Baden—Only known as yet from the original locality at Eberbach on Neckar.

FIG. 23. — *Helix rufescens* var. *subcarinata* Clessin × 1½ (after Clessin).

VARIATIONS IN SIZE OF SHELL.

Var. **major** Taylor.

SHELL larger than the type form, reaching almost 15 mill. in diameter.

ENGLAND AND WALES.

Dorset—Mr. J. C. Mansel Pleydell recorded some extremely large specimens, double the ordinary size, from Puncknowle (Moll. Dorset, 1899, p. 10).
Wilts. N.—Purton Marsh ! Rev. J. Going.

IRELAND.

Kerry—Specimens 14 mill. in diameter from roadside-walls, Mucksna Wood, Kenmare, July 1898, R. Standen.

CONTINENTAL DISTRIBUTION.

Germany—Stuttgart, Wurtemburg ! Prof. E. von Martens. The large var. *alluvians* Clessin is recorded from the valley of the Danube, Bavaria.

Var. **minor** Jeffreys, Brit. Conch., 1862, vol. i., p. 195.

Helix rufescens var. *montana-minor* Westerlund, Fauna Extram., 1878, p. 48.

SHELL smaller with usually a more elevated spire.

According to Dr. Jeffreys, it is not uncommon, and its occurrence has been verified in many parts of the country ; perhaps the most characteristic shell I have seen was found by Mr. W. E. Brady at Bretton West, near Barnsley, Yorkshire.

This variety probably embraces the var. **montana-minor** Westl., which is characterized by a lofty, globosely-conoid spire, and has a diameter of 8 mill. and an alt. of 5½ mill., and is only recorded from Switzerland and Mariabrunn, Bavaria, and is considered by Clessin to also embrace the *Trichia erecta* of Hartmann, a compact and regularly conical shell, found at Neuwied in Rhenish Prussia.

The var. *montana-minor* is recorded from Alsace, Baden, and Rhenish Prussia in Germany ; and also from Switzerland, France, and Austria.

VARIATIONS OF COLOUR OF SHELL.

Var. **rubens** Moquin-Tandon, Hist. Moll., 1855, vol. ii., p. 206.

SHELL of a dark reddish-brown.

The var. **rubens** s.s. is described as SHELL more or less reddish.

This variety was first distinguished but not described by Bouchard-Chantereaux in 1838, and was evidently intended to distinguish the deeper red-brown forms; but the brightness and richness of the tint gradually fades with time.

Judging by the specimens in my collection, it is the var. *purpurascens* of Cockerell, his var. *rubens* being a paler form than that considered here as typical, though this may be due to fading.

This variety is widely distributed in the British Isles, and is also known abroad, although few precise records are available. Moquin-Tandon, however, reports it from Boulogne, France.

Var. **alba** Moquin-Tandon, Hist. Moll., 1855, vol. ii., p. 206.

Helix rufescens var. *albida* Jeffreys, Brit. Conch., 1862, i., p. 195.

SHELL entirely white.

The sub-var. **albida** Jeffreys is described as shell white or colourless.

This variety was named var. *alba*, but not described by Bouchard-Chantereaux in 1836. It is also in part the var. *albida* of Jeffreys.

The *Helix rufescens* var. *manchesteriensis* Locard, judging from Bristol specimens in the Westerlund Collection at the Dublin National Museum, are merely the albine form of the species.

Prof. A. E. Boycott remarked that the albine form was the only one found on horse-radish at Ross, Hereford; and Mr. Swanton has recorded its preference for the leaves of *Arum maculatum* in Somerset.

This variety is fairly common and widely distributed in these islands, and is known on the continent, but few precise records exist. Moquin-Tandon reports it from Boulogne, France; and Mr. G. H. Clapp from Quebec, Canada.

A specimen found at Matlock, Derbyshire, by Mr. Hurlstone Jones, had the last whorl only albine, the rest of the shell being normal in character.

Var. **albocincta** Cockerell.

Helix circinata Studer, Syst. Verz., p. 86, 1821.
Helix rufescens var. *albocincta* Cockerell, Nat. World, Sept. 1886, p. 179.

SHELL showing a distinct white zone at the periphery.

The var. **albocincta** Ckll., s.s., is described as "purplish-brown with a white band at the periphery."

This variety is probably an atavic one, the pale zone representing the area intervening between the colouring of the upper and lower surface of the shell. It is apparently most commonly found in a distinctly characterized form in unfavourable localities or in areas verging on the limits of the geographical range of the species.

According to Dumont and Mortillet this form is the *Helix circinata* of Studer, but in view of the present uncertainty of the nomenclature and identification, Prof. Cockerell's name is here used. Moquin-Tandon, who alludes to this form as *H. rufescens* var. *circinata*, by some oversight describes the band as dark coloured.

This variety is probably the *Helix* (*Trichia*) *montana* var. *obscura* Wattebled, which is distinguished by its dark horny-fawn colour and whitish peripheral zone. It is known from the Jura and Vaucluse, France.

In the British Isles, the var. *albocincta* is more especially found in Ireland, but has been found in several comital districts in England.

On the continent, it is recorded as *Helix circinata* from the Jura Mountains by Dumont and Mortillet; and as *H. rufescens* var. *albocincta* from Goat Island, Niagara, United States, by Rev. C. E. Y. Kendall.

Var. **clessini** Weinland, Weichth. Schwab. Alb., 1876, p. 53.

SHELL retaining in adult life the hairy epidermis proper to its very youthful stage.

This variety, which has been as yet found only in the original locality, the damp forest drains on the Vottelwiese, Wurtemburg, but will probably be eventually also found in moist shady surroundings in this country.

MONSTROSITIES.

Monst. **subscalare** Williams, Midl. Nat., July 1890, p. 165.

Helix rufescens monst. *scalariforme* Swanton, Journ. of Conch., April 1905.

"Whorls partly disjointed."

Dr. Jeffreys mentions a scalariform distortion of this species, but gives no indication of the locality.

ENGLAND.

Surrey—A peculiar dislocated shell found at Haslemere! by Mr. E. W. Swanton.

Norfolk E.—A single specimen found by Mr. A. Mayfield at Eaton near Norwich, is the type of the monst. *subscalare*.

Westmorland and Lake Lancashire.—Eggerslack Wood, Grange-over-Sands, 1903, J. Wilfrid Jackson.

IRELAND.

Queen's Co.—Maryborough, a very fine example, Oct. 1910! R. A. Phillips.

Monst. **sinistrorsum** Taylor.

SHELL reversed in its coiling.

This species, though so abundant, was quite unknown in the sinistral state until discovered by the Rev. W. A. Shaw in 1905. It is very remarkable that the only other known specimen should have been found in the same county.

ENGLAND.

Northampton—A single almost full-grown shell amongst nettles at East Haddon, May 1905, Rev. W. A. Shaw. A full-grown and perfect, though dead shell, in a nettle-bed, about a mile from Peterborough Railway Station, Aug. 1909, W. Gyngell.

Geographical Distribution.—This species is fairly well diffused throughout its range in the British Isles, and not nearly so partial in its distribution as believed by Dr. Jeffreys.

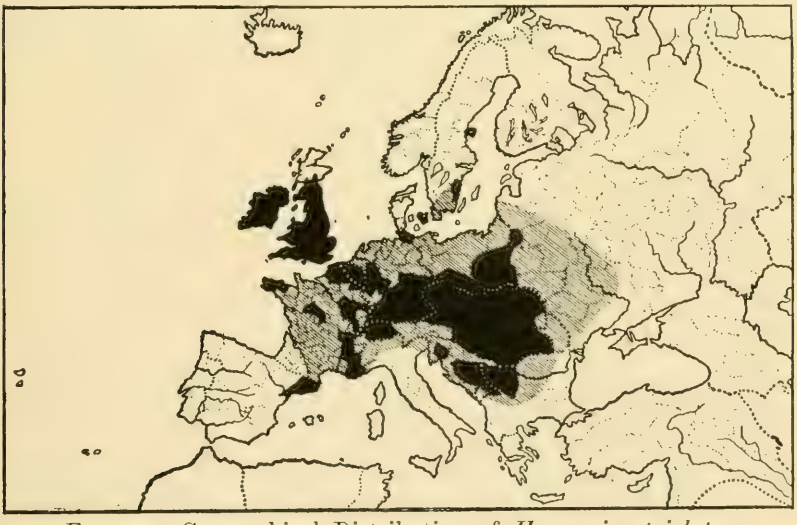


FIG. 24.—Geographical Distribution of *Hygromia striolata*.

In England and Wales it has been found and verified for every comital or vice-comital district except from Nottingham and Montgomery; the apparent and totally unexpected absence of this species from Nottinghamshire and excessive rarity in Leicestershire are as yet quite inexplicable.

Though frequently recorded as a striking absentee from the Channel Islands, it is stated by Mr. C. E. Wright to be common all over the Island of Guernsey.

In Scotland, *H. striolata*, though thought by Dr. Jeffreys to be absent from that country, ranges as far north as Kinnoul in North Perthshire, but apparently has not yet succeeded in crossing the great rift valley now occupied by the Caledonian Canal.

About a quarter of a century ago English specimens were introduced at Brora, East Sutherland, by Mr. W. Baillie, and have prospered amazingly in their new surroundings.

In Ireland, it is diffused throughout the whole country, and its occurrence has been verified for every district. It is, however, rare in the North-east, its place being taken by *H. hispida*, with which it is said by Irish conchologists to insensibly blend.

Its Continental range is clouded with considerable uncertainty, due to the conflicting opinions of foreign conchologists as to the correlation of the British and continental *Hygromiæ*, for, as remarked by the late Dr. Gray, the *Helix concinna* "is the *Helix rufescens* of the Swiss conchologists," and the views of authors still so greatly diverge regarding the status and intimate relationship of *H. calata*, *H. circinata*, *H. plebeia*, *H. sylvestris*, *H. glabella*, and other *Hygromiæ*, which are allocated almost indifferently to *H. montana*, *H. concinna*, *H. strigella*, *H. striolata*, *H. altenana*, etc., or even given distinct specific status.

Its distribution is given by Dr. H. Jordan as England, South Ireland, South Scandinavia, Holland, Belgium, North and East France, the Mid-Rhine Valley, Switzerland, Jura Mountains, South-west Germany, Saxony, Silesia, Bohemia, Moravia, Upper and Lower Hungary, Lower Danubian Valley, North and Central Carpathians, and Eastern and Western Alps, at from 1,500–4,000 feet.

The natural occurrence of this species in Asia does not seem as yet to be satisfactorily verified.

GERMANY.

As *Helix striolata* it is recorded by C. Pfeiffer as plentiful in gardens about Heidelberg, Baden.

As *Helix rufescens* it has been recorded from Nassau by Dr. Scharff; from Zwickau, Saxony, by Mr. G. K. Gude; from Baden, Franconia, Rhenish Prussia, and Bavaria by Herr Clessin; from Suabia and Wurtemburg by Dr. Weinland; from Holstein by Beck; and from Fulda by Kugler.

As *Helix montana* from Rhenish Prussia by Schmidt; and from the Castle Hill, Heidelberg, Baden, by C. Pfeiffer.

As *Helix sylvestris* it has, according to Dr. Jeffreys, been noted from North Germany by von Alten.

As *Helix circinata* it is reported from the Taunus by Dr. Heynemann; from Thuringia by Prof. von Martens; from Wurtemburg by Seckendorff; from Franconia by Küster; and from Rhenish Prussia by Busch.

As *Helix glabella* it is recorded from Cassel by C. Pfeiffer; and from Alsace by Dr. Mühlenbeck.

It lives in the whole range of the Austrian and Bavarian Alps; in Moravia and the Isergeberge in Silesia; in Bohemia and Saxon Elbe region, and Transylvania.

NETHERLANDS.

In **Belgium** it is recorded as *Helix rufescens* from Namur by Malzine; as *Helix rufescens* (= *H. altenana* v. Ben.) from Mechlin in the province of Antwerp by Colbeau; and as *H. rufescens* var. *montana* by Mr. Gude from Grand Duchy of Luxemburg.

As *H. altenana* M. Colbeau records it from Brabant, on the authority of Kickx; and doubtfully from Namur on the authority of Nyst.

In **Holland** it is recorded as *Helix glabella* from Oudwyk by Maitland.

FRANCE.

Its distribution is little known in France, but Dupuy and Grateloup record it under the name of *Helix rufescens* from North and East France; and Moquin-Tandon reports it as inhabiting the departments of the Ain, Nord, and Pas-de-Calais, yet Reeve states that "it is not found in the north of France." Mr. F. H. Sikes found it in Loir-et-Cher and Indre-et-Loire; Rev. S. Spencer Pearce in Isère; M. Bourguignat notes it from Finistère and Côtes-du-Nord; Captain Wattebled found it commonly in the Jura; Locard records it from the Rhône; M. Picard from the Somme; M. Cardot from the Ardennes; and Abbe Dupuy from the Vosges.

As *Helix glabella* it is reported by Dr. Jeffreys on the authority of Barbie from Burgundy; Grateloup gives the distribution as North and South France, Dauphiny, Seine, Côte-d'Or, and Rhône; M. Margier quotes it as common about Beauvezer, Basses Alpes; Puton records it from the Vosges; and Fagot and Malafosse from Champagne Meridionale.

As *Helix montana* it is quoted from Hautes Alpes, Jura, and Alpine France, by Grateloup; and from the Drôme by Sayn.

As *Helix altenana* Grateloup gives it as found in Northern and Eastern France.

ITALY.

Sicily—Quoted as *Helix glabella* by Dr. Gwyn Jeffreys on the authority of Calcara.

BALKAN PENINSULA.

Servia—Prof. Sandberger records it from the valley of the Danube.

AUSTRO-HUNGARY.

As *H. rufescens* it is recorded for Austria by Shröckinger; Prof. Brusina has noted its occurrence in Bosnia; Jachno has recorded fine specimens from near Cracow, Galicia; Sandberger quotes Galicia; and Dr. H. Jordan tabulates it as inhabiting North and South Hungary, Silesia, Bohemia, and Moravia.

As *H. montana* it is recorded from the woods about Vienna, Austria, by Herr Carl Pfeiffer.

As *H. circinata* it is quoted from Carniola by Dr. F. J. Schmidt.

SWITZERLAND.

As *Helix rufescens* it is represented in the Manchester Museum from Switzerland; Mr. J. R. le B. Tomlin has found our species at Lucerne!; and Mr. Hugh Watson near Solothurn; and Dr. G. Bollinger cites its occurrence at Basle, Berne, and St. Gallen.

As *H. montana* it is quoted by Prof. von Martens from Neuchâtel, and from Bremi, Zurich.

As *H. glabella* it is recorded from the Grisons by Am Stein; Hartmann gives *H. corrugata* and *H. clandestina* from Zurich; and Herr Studer quotes *H. cælata* and *H. montana* from Neuchâtel.

SPAIN.

As *H. rufescens* it is recorded by Salvana from Valvidrera near Gerona, Catalonia.

SCANDINAVIA.

Sweden—Dr. Westerlund records its occurrence near Kalmar.

Denmark—Reported from Holsteinborg, Zealand, by Mörch; and Westerlund cites var. *submontana* from the Island of Möen.

RUSSIA.

South Russia—The var. *nordenskjoldi* is recorded by Dr. Westerlund.

Poland—Recorded by Slosarski from Ojcow, Putawy, and Kazimierz.

ATLANTIC ISLANDS.

Madeira—Found in 1890 at Funchal by Dr. W. H. Rush (Nautilus, Sept. 1891, p. 49). Erroneously quoted by Dr. Gwyn Jeffreys on the authority of Mr. Lowe.

NORTH AFRICA.

Algeria—M. Morelet in 1853 recorded this species from Génois near Bône, but the correctness of his identification has been doubted by M. Bourguignat.

SIBERIAN SUB-REGION.

Recorded by Dr. Gwyn Jeffreys as inhabiting Siberia, on the authority of Krynicki; and by Mr. G. K. Gude as *Fruticicola rufescens* = *strigella* Gerstfeldt from Irkutsch, the Amur valley, and the Altai region.

The var. *nordenskjoldi* Westl. is cited by its author for East and West Siberia and the Altai-Baikal region.

NEARCTIC REGION.

United States—Recorded by Mr. J. H. Thomson as living in 1859 and 1860 near the "French watering place" on the south side of Naushon Island, Buzzard's Bay, Massachussetts; also on Goat Island, Niagara, New York, May 1912, Rev. C. E. Y. Kendall.

Canada—Very abundant throughout Quebec, especially on the city-walls, the cliffs, and extending some distance up the St. Lawrence; there is a large colony at St. Sauveur; a few on the banks of River St. Charles, and on the Isle d'Orleans close to the ferry landing. It is also recorded from Levis by Abbé Begin, and appears to be spreading rapidly (A. W. Hanham, Nautilus, Jan. 1897).

Portrait and Autograph of Thos. Pennant, the author of British Zoology, with whose name this species has been for so long incorrectly associated.

Distribution of *Hygromia striolata* (C. Pfr.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

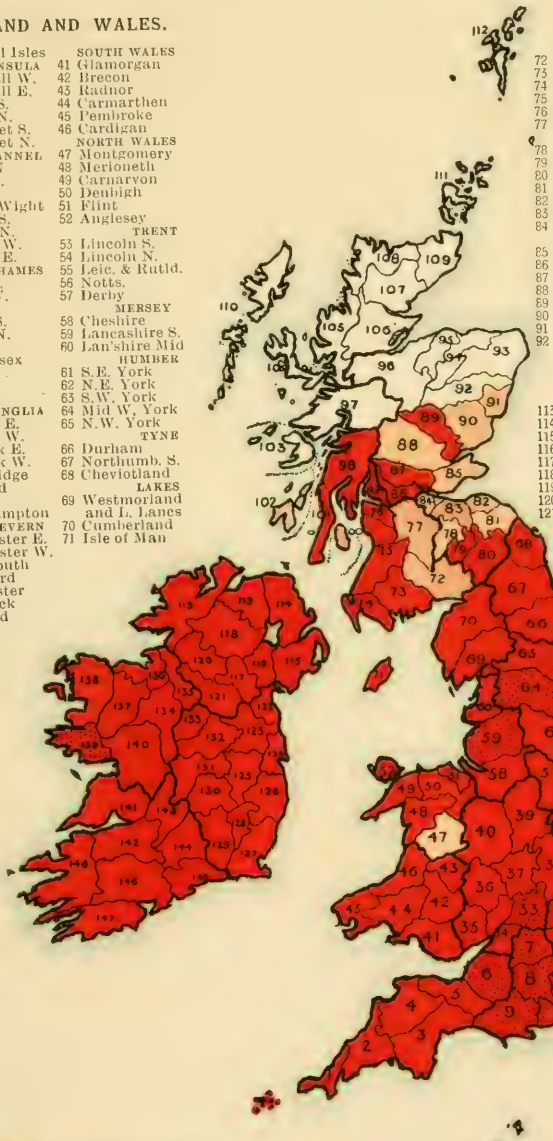
Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop
SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lancs
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.
E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan
LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford
CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

Hygromia hispida (Linné).

1702 *Cochlea terrestris lutofa*, Petiver, Gaz., tab. 93, ff. 12, 14.
1712 *Cochlea e compreffis, coloris subfusci, clavicula productiore, quinque spirarum, ex altera parte umbilicata, et subtiliter echinata*, Morton's Northampton, ch. 7, p. 416.
1746 *Cochlea testa utrinque convexa hispida, spiris quinque rotundatis, subtus perforata*, Linnæus, Fauna Suec., i., p. 371.
1767 *La Velouteé* Geoffroy, Coquilles de Paris, p. 44, no. 11.

1758 *Helix* **hispida** Linné, Syst. Nat., ed. x., p. 771.
1801 — *sericea* Draparnaud, Tabl. Moll., p. 85.
1803 — *rufescens* var., Mont. Test. Brit., p. 421, pl. 23, f. 2.
1830 — *concinna* Jeffreys, Linn. Trans., xvi., p. 336.
1869 — *vendeana* Letourneaux, Catal. Vendeé, p. 17.
1869 — (*Zenobia*) *hispida* Slavik, Moll. Böhm., p. 98.
1871 — *liberta* Westerlund, Moll. Suède et Norv., p. 54.
1766 *Trochulus hispidus* Chemn., Conch. Cab., ix., pt. 2, p. 52, pl. 122, ff. 1057–8.
1826 *Helicella hispida* Risso, Moll. Alp. Marit., p. 72.
1837 *Bradybæna hispida* Beck, Index Moll., p. 20.
1837 *Fruticicola hispida* Held, Isis, p. 914.
1852 *Teba hispida* Leach, Syn., p. 71.
1858 **Hygromia** *hispida* Adams, Genera of Recent Moll., p. 214.
1865 — (*Monacha*) *hispida* Mörch, Journ. de Conch., xiii., p. 383.

C. A. Westerlund.

HISTORY.—*Hygromia hispida* (*hispida*, hairy) was first noticed by our famous countryman Dr. Martin Lister, if his *Cochlea subfusca claviculâ modicé productâ* be really this species, as surmised by Morton in 1712; but the publication by Petiver is, however, the generally accepted record of its first discovery in this country.

It is the *Helix hispida* of Linné, and the type specimen existed in the Linnean Collection, and may still be in existence, and have escaped the search made for it by Mr. Roebuck and myself when we examined and isolated all the British land and freshwater shells in the Linnean cabinets.

Mr. Hanley recorded its presence in the Linnean collection, and I saw it there when I looked over the specimens about thirty years ago. As stated by Mr. Hanley it was clearly the somewhat flat, widely umbilicated form described as *Helix concinna* by Dr. Gwyn Jeffreys.

The present species is dedicated with profound respect to the late Dr. Carl Agardh Westerlund, the distinguished conchologist, of Ronneby, Sweden, who has rendered such immense services to the investigation of the Palæarctic terrestrial mollusca.

There has been considerable divergence of opinion amongst conchologists in reference to the group of species or varieties clustering around *H. hispida*.

The *H. hispida* of Moquin-Tandon must be a different species to our own if his description of the reproductive organs is to be relied upon, as he describes his species as possessing only one dart-sac, whereas our species is always provided with two, each furnished with a love-dart, and also an accessory superimposed glandular sac; while Dr. Paetel regarded the

H. hispida of Jeffreys as identical with *Helix conspurcata* of Draparnaud, a calcareous xerophilous species allied to *H. caperata*.

The *H. concinna* of Moquin-Tandon, Dupuy, and other French authors is not the shell to which that name is correctly applied, but is a form with a minute umbilicus, and bearing long stiff, whitish hairs, which are not stated to be hooked or incurved.

The *Helix vendeana* Letourneaux, an openly umbilicated form, from the Vendée, France, is described by its author as intermediate between *H. hispida* and *H. concinna*.

Helix axoniania, *H. goosensis*, and *H. matronica* of Mabille, the *H. choanomphala*, *H. culurensis*, *H. duboisiana*, *H. microgyra*, *H. vendoperanensis*, and *H. vocontiana* of Bourguignat are all regarded by Dr. Kobelt as more or less unimportant forms of *Hygromia hispida*; as are *Helix locardiana* Fagot, *H. neyronensis* Fagot, *H. steneligma* Bourguignat, and *H. elaverana* Mabille, according to Dr. P. Fischer; while Dr. Pilsbry includes as varieties *beaudouini* and *laticensis* of Locard; and Dr. Germain considers that the *Helix elisula* Locard is only a widely umbilicated form of this species, and the *H. praviata* a form of what he regards as *H. concinna*, both being found in the quaternary beds at Buisse, Isère, France. He also regards as strictly synonymous, or as ill-defined varieties, *Helix falsani*, *H. calcica*, *H. locardi*, and *H. neyronensis*, all fossils found in the vicinity of Lyons.

Diagnosis.—*Hygromia hispida* when mature chiefly differs from *H. striolata* in the smaller size and more or less hispid shell, and may be distinguished from the immature stages of *H. striolata* of a similar size, by the fewer and more rapidly enlarging whorls and the prominence and more elevated position of the peripheral angularity in the latter species.

H. granulata is a more globose shell, with a much more minute umbilicus, and the epidermal hairs with which the shell is clothed are longer and nearly or quite straight, not hooked and incurved as in the present species.

INTERNALLY, *H. hispida* differs chiefly from *H. striolata* in the short and squat teeth of the radula, differing markedly from the more elongate denticles of *H. striolata*; the mucous glands are also comparatively longer and scarcely so flexuous.

The structural differences of *H. granulata* are very striking, shown by the total absence of darts, dart-sacs, digitate mucus glands, etc., in *H. granulata*, all of which are so strongly developed in *H. hispida*.

Description—SHELL subconical, rather solid, somewhat glossy, usually of a greyish or yellowish-brown colour, and distinctly striate transversely; PERIPHERY rounded, and sometimes showing a paler zone; EPIDERMIS rather thick, with a number of short and incurved whitish hairs, which are somewhat caducous, and directed forwards towards the mouth of the shell; WHORLS 6–7, compact, and increasing slowly and gradually in size; SUTURE deep; MOUTH obliquely lunate, with a distinct white submarginal rib, most strongly developed basally; the UMBILICUS is rather broad, open, and deep; and the LIP slightly reflected.

Diam., 8 mill.; alt. 5 mill. The average weight of the shell is about 0·6 of a grain.

FIG. 27. FIG. 28.

FIG. 27.—Hairs from the shell of *H. hispida*, ×90 (after micro-photograph by Mr. W. Bagshaw).

FIG. 28.—Sculpture of the shell surface of *H. hispida* (after Sandberger), greatly magnified.

The ANIMAL is elongate and slender when crawling, and usually of a black or dark grey colour, but much paler posteriorly, with a coarsely granulate surface, the granules being densely besprinkled with numerous minute whitish specks;

the somewhat indistinct DORSAL GROOVES enclose a row of elongate tubercles, and there is no perceptible trace of facial or lateral furrows; the slightly darker subdorsal lines are due to the tentacular retractors being visible through the skin, and are most perceptible by transmitted light. The MANTLE is grey, with darker grey and white mottlings, which are sometimes visible through the shell. The MUZZLE is somewhat elongated, the upper and lower TENTACLES being well separated; OMMATOPHORES long, slender, and divergent; lower tentacles short; FOOT-SOLE long and narrow, of an almost uniform pale slate colour, but darker in front, marginally paler, but occasionally showing a darker submarginal line, and a distinctly crenulate margin. The EPIPHRAGM is thin and crinkled, beset with calcareous particles, and is affixed slightly within the aperture.

INTERNAL ORGANIZATION—The HEART is small and white, the RENAL ORGAN buff or cream-coloured at the margins with dark brown spots or blotches, the central vein with lateral ramifications. The DIGESTIVE GLAND is whitish, light buff or reddish-brown, the hepatic artery tinged blue, the intestinal folds olive-brown or greyish-white, perhaps in correspondence with the colour of their contents.

The TENTACULAR RETRACTORS, according to a dissection by Miss Marie V. Lebour, show the unusual feature of a trifid basal division of the tentacular muscles, the left OMMATOPHORE possessing a special muscular strip emanating from or near its origin or base; the two main muscles divide somewhat deeply; that serving the left side bears only the retractor of the left lower tentacle and the broad sheaf of muscles for the anterior part of the foot; the tentacular muscle of the right side gives off slips to the right ommatophore and lower tentacle and also a powerful trifid muscle to the foot.

FIG. 29.—Cephalic and anterior pedal retractors of *H. hispida* L. (greatly enlarged), from a dissection and drawing by Miss M. V. Lebour.

The REPRODUCTIVE ORGANS show a fairly long and much convoluted HERMAPHRODITE DUCT; the ALBUMEN GLAND is of the usual shape, of a yellowish-white, pale lavender, or grey; the OVIDUCT is pale and transparent and tinged with lavender; the PROSTATE or sperm-duct is opaque white or buff, well defined, and widest in the middle of its course; the FREE OVIDUCT is usually whitish-grey; the SPERMATHECA and its duct are whitish tinged with buff, the spermatheca has a yellowish-white core, and the whole organ is sometimes minutely spotted with yellowish-white; the MUCUS GLANDS are somewhat rigid, and eight in number, disposed in four pairs around the vagina above the dart-sacs, they are about three mill. long, digitiform or tubular in shape, usually of a transparent azure white, with opaque creamy or buff cores, especially noticeable towards the slightly swollen extremities, and are joined to the vagina by a constricted neck; the PENIS-SHEATH is whitish-grey, tinged with azure, and minutely spotted, very swollen in shape and distinctly constricted at its junction with the ATRIUM; the EPIPHALLUS is equal in length to the penis-sheath, of similar colouring, and boldly twisted towards its distal end, which would indicate that the spermatophore when discovered will show a corresponding peculiarity; the FLAGELLUM is comparatively short and stout and also partakes of the same pigmentation as the related organs.

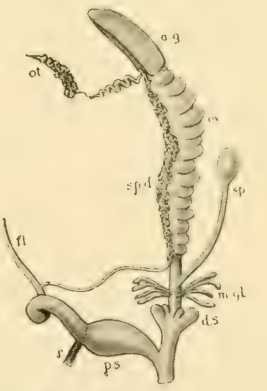


FIG. 30. — Reproductive organs of *Hygromia hispida*, enlarged.
a.g. albumen gland; *d.s.* dart sacs; *fl.* flagellum; *m.gl.* mucus glands; *ov.* oviduct; *ot.* ovotestis; *p.s.* penis sheath; *r.* penial retractor; *sp.* spermatheca; *sp.d.* sperm duct or prostate.

The STYLOPHORES or dart-sacs are bilobed and laterally paired clavate structures of a yellowish or whitish colour, finely spotted with brown, and placed on opposite sides of the vagina; they are each composed of a larger functional outer sac, each of which secretes and contains a dart, and also possesses a smaller or inner sac or lobe which is usually somewhat more opaque than the outer lobe and is always empty, showing no signs of having ever possessed a dart, so that it is not improb-

able that these auxiliary and empty sacs in the present and certain other species represent the coronal glands present in *Zonitoides*.

Fig. 31.

Fig. 32.

Fig. 33.

Fig. 31.—Dart sacs and mucus glands of *Hygromia hispida*, greatly enlarged (after Ashford).
Fig. 32.—Diagram showing the paired arrangement of the vaginal mucus glands (after Ashford).
Fig. 33.—Darts of *Hygromia hispida*, showing the curved and straight form of dart, × 24.

The GYPSOBELA or love-darts are two in number, about 0·75 mill. in length, of a crystalline white, and usually curved or awl-shaped, though occasionally straight, with a slender, smooth, and tapering shaft, and a comparatively bulky base, with only occasionally slight indications of an annulus.

JAW strongly arcuate, with an indistinct blunt median rostrum or beak, and showing numerous flattish ribs on the anterior surface, which are rendered strikingly perceptible by their distinct and apparently grooved lines of demarcation; there are also several subsidiary intermediate lines; the jaw is of a deep amber colour, darker along the lower or cutting margin, but deepest in the central area, indicating the line of attachment of the buccal tissues. The concave margin is broadly crenulate, the indentations marking the limits of the plates of which the jaw is composed.

Fig. 34.

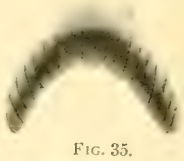


Fig. 35.

Fig. 34.—Jaw of *H. hispida* L. (the *H. concinna* of Jeffreys) × 30 (after micro-photograph by Mr. W. Bagshaw).
Fig. 35.—Jaw of *H. hispida* var. *hispidosa* (the *H. hispida* of Jeffreys) × 30 (after micro-photograph by Mr. W. Bagshaw).

The RADULA is of the usual oblong shape, and about 2½ mill. long, and 1 mill. wide, with about 100 sinuately transverse rows of teeth, each row containing on the average about 61 teeth, composed of a short, almost quadrate, tricuspid median tooth, about 10 more or less obliquely quadrate bicuspidate laterals, of which the reflection gradually becomes more slender and elongate as the teeth recede from

Fig. 36.—Representative denticles from the radula of *Hygromia hispida*, collected by Major Barrett-Hamilton at Kilmanock, Wexford, and photographed by Mr. Walter Bagshaw, from a preparation by Mr. J. W. Neville (highly magnified).

the centre and approximating somewhat to the marginals, which are about twenty in number, distinguished by their diminished basal plates and relatively enormous cutting points; the marginals, though at first bifid and not greatly different in size, become rapidly reduced in their dimensions, and trifid or even quadrifid as they approach the outer margin of the radula.

The formula of a Kilmanock specimen, collected by Major Barrett-Hamilton, is

$$\frac{2\,0}{2\cdot3}+\frac{1\,0}{2}+\frac{1}{3}+\frac{1\,0}{2}+\frac{2\,0}{2\cdot3}\times 100=6{,}100 \text{ teeth.}$$

Reproduction and Development.—Nothing has been hitherto noted in reference to the details of sexual congress in this species, but it is known that this may take place during mild weather throughout the season and may occur even before the maturity of the shell.

The eggs are from 30–40 in number; they are globose, opaque, and white, about 1 mill. in diameter. They are laid from April to September, and hatch in from 20–25 days, and become adult during the second season; the young shell when hatched is flat and has then but a single whorl, which is said to be more than half covered with short and straight red hairs, which become stronger as they approach the lip.

Food.—In captivity, *Hygromia hispida* is, according to Dr. Gain, very fastidious in the choice of foods, for out of 192 different kinds offered, they left 124 absolutely untouched, and though only two—beans and the roots of carrot—were voraciously devoured, yet 36 others were eaten quite freely, amongst them being cabbage, turnip, clover, the fruits of gooseberry, strawberry, and raspberry, and the fungi, *Armillaria melleus* and *Russula heterophylla*.

H. hispida is one of the pests of moist gardens, and though said to feed on dead plants, also attacks living ones. It has been noticed in Scotland feeding upon reeds, and Dr. Baudon says they are very fond of the gum which exudes from certain trees.

Habits and Habitat.—Like most other species, *Hygromia hispida* is naturally nocturnal or crepuscular in its habits, only venturing forth during the day in damp, cloudy, or showery weather, hiding in dry weather amongst moss or beneath stones, logs, dead leaves, rubbish, etc., on roadsides, in shady woods, hedgerows, gardens, and other places, and though chiefly inhabiting the lower grounds, is known to ascend to an altitude of 6,000 feet in the Alps and elsewhere, and the var. *sericea* reaches beyond 8,000 feet in the Valais.

It is very partial to a moist and shady environment, and congregates in nettle-beds, and ivy-covered walls, trees, or hedges, as well as on herbage generally, from which specimens can sometimes be obtained in great numbers by sweeping with an entomological net.

The animal is somewhat sensitive, yet not very active, carrying its shell sometimes almost horizontally, while at other times it may be held nearly vertically or sloping strongly towards the front or the right side.

The degree of hairiness of the shell is also very variable, but the investment is always most dense in immature shells and on those found living amongst nettles and other vegetation in moist places; it has also been remarked that the very hispid form is especially characteristic of beech woods, their dense shade being apparently favourable to the development of the hispid investment, which is correlated with the aspect of the shell, this being always duller in the densely hispid specimens, becoming smoother and brighter in proportion as the hairs are less numerous.

The hairs with which this species is often so richly furnished are frequently covered with muddy particles, and the shell is then easily passed over as a piece of dirt, and Dr. Pilsbry is of opinion that the concealment of the shell by this means is the function of the hispid epidermis.

The adaptive character of *H. hispida* is demonstrated by its ability to exist in the driest as well as in the moistest places, for it has been found abundantly on the North Yorkshire sandhills, and also occurs in very humid situations. Its plasticity of organization enables it to follow on occasion a subhalophilous life; to inhabit dry and sunny calcareous pastures on *Thymus serpyllum* in association with *Helicella itala*; to live amongst *Tanacetum vulgare* on Millstone Grit in company with *Helix*

hortensis; to share with *H. hortensis*, *H. striolata*, and *H. granulata* the marginal portions of ash and hazel copses; and may even live upon wet rocks on the sea shore, close by high water mark.

It is an almost amphibious species, and resists prolonged immersion, Mr. E. J. Lowe recording that he retained five specimens under water for a fortnight, and only one of the animals succumbed; and Rev. Revett Sheppard states that he frequently found this species some feet below the surface of the water on stakes and piles upon which it ascends and descends at pleasure.

It is a hardy species, one of the very last to retire in winter, and one of the first to reappear in spring, frequently also breaking its hibernation, and wandering about during the milder days in the depth of winter. It is only during severe cold that it burrows in the ground; ordinarily it is content to ensconce among vegetable refuse or within suitable sheltered crevices.

The heart of a Kilmanock specimen, collected by Major Barrett-Hamilton, was observed to contract 24 times per minute at a temperature of 54° Fahr. in April. The average pulse rate of the species may vary from 10 to 15 pulsations per minute in the average temperature of our winter months and reach 70 or 80 in the hot harvest days of August.

Parasites and Enemies. — This species is especially utilised by sparrows as food for their young, and also probably for their own sustenance; and landrails have been found with their crops full of the shells of the species. It is also preyed upon by thrushes, their shells being often found at thrush-stones.

Geological Distribution.—Though the present species is, according to Dr. Fischer, known from deposits of the Miocene period in France and Belgium, yet in this country it has not been discovered below strata of Pliocene age, and has been described as the commonest Helicoid of our Pliocene and Pleistocene deposits, as well as those of Holocene age.

Miocene.—In France, it is recorded by the Abbé Dupuy from the deposits of Sansan, department of Gers.

In Belgium, it is reported by Messrs. Cornet and Rutot from deposits at Mesvin and Mons, Hainault, and by M. Vincent from Veeweyde near Duysburg.

Pliocene.—Mr. F. W. Harmer, the most recent authority, cites it as found in the Butleyan or Red Crag, Butley, Suffolk.

In the Icenian Crag it is known from the Norwich zone at Bramerton, Thorpe, Horstead, and Coltishall, Norfolk; as well as at Dunwich, Bulchamp, and the Old Crag Pit at Yarn Hill, Wrentham, near Southwold, Suffolk.

In the Weybourne zone it is cited for East Runton, North Walsham, and from the freshwater bed at West Runton, Norfolk.

Pleistocene.—In Wiltshire, it is recorded by Dr. Blackmore from the gravels of Milford Hill and the loess of Fisherton-Anger, near Salisbury.

In Sussex, it is recorded from Selsey by Mr. Alfred Bell; and from West Wittering by Mr. J. P. Johnson.

In Kent, it is recorded by Prof. Morris from the freshwater Pleistocene deposits of Charing and Maidstone; by Dr. Sandberger from Crayford; by Rev. R. A. Bullen from a pre-Neolithic stratum at Barton Court, Dover; by Dr. Gwyn Jeffreys from Folkestone; Mr. A. S. Kennard from Halling; Mr. B. B. Woodward from Erith; and by Kennard and Woodward from the Ightham fissure and Swanscomb.

In Essex, Prof. Morris records it from the freshwater marls of Clacton and Grays; and Mr. J. P. Johnson has found it in the Uphall brick-yard, Ilford.

In Middlesex, Mr. W. G. Smith records it from the "Palæolithic floor," Stoke Newington, near Clapton Railway Station; Mr. B. B. Woodward from Brentford; and Kennard and Woodward from a sandy section exposed in the excavation in St. James Square, London.

In Suffolk, Prof. Morris recorded it from the freshwater marls of Stutton.

In Cambridge, Mrs. McKenny Hughes records it from the gravels of Barnwell, Barrington, and Grantchester near Cambridge; and Rev. E. S. Dewick found a fossil specimen of the sinistral form at Barnwell.

In Bedford, it was found by Prof. Prestwich at Biddenham.

In Huntingdon, a large, robust and compact form with a wide umbilicus was found abundantly in the alluvial deposit at Woodston by the Rev. C. E. Y. Kendall who regarded them as undoubtedly the ancestral type of the species.

In Northampton, Kennard and Woodward report it from Apethorpe.

In Pembroke, Dr. Falconer found it in Minchin Hole Cave.

In Lincoln South, it is reported by Mr. H. E. Quilter as rare in a pre-glacial deposit at Casewick cutting.

In Derby, Rev. E. H. Mullins has found it in Langwith Cave.

In Lancashire, *H. hispida* and var. *sericea* Drap. have been found in the "cave earth," Dog Holes, Warton, near Carnforth, by Mr. J. Wilfrid Jackson.

In Yorkshire, Mr. T. Sheppard records it from Bielbecks, near Hornsea.

In Germany, it is recorded by Prof. Ihering from the tufa of Streitberg and Ober Zaunsbach, Franconia; and by Herr P. Hesse from calcareous tufa and peat at Pyrmont.

Herr Clessin also reports from Bavaria *H. hispida* from loess of the Danubian valley; *H. hispida* and var. *minor* at Pürklgut; and *H. hispida*, *H. concinna*, and var. *conica* Jeffr. from the tufa of Regensburg.

In the Lower Pleistocene, Prof. Sandberger records it from Mosbach, Baden; also from Burgtonna, Grafentonna, Muhlhausen, and Weimar, Thuringia.

From Lower and Middle Pleistocene, Prof. Sandberger cites it from Achern, Bretten, Bruchsal, Durlach, Heidelberg, Mauer, Oos, Oberweiler, Steinbach, and Sulzburg, Baden; from Cannstadt and Neckarelz in the Neckar Valley; from Bad Ems, Garbenheim, Limburg, Oppenheim, Weilburg and Wiesbaden in Hesse-Nassau; from Frankenhausen and Sondershausen, Thuringia; from Dresden, Meissen, and Priesa in Saxony; from Passau, Bavaria, as well as from Nidda and Geisnidda in the Niddathal.

In the Upper Pleistocene tufa-beds, Prof. Sandberger reports it from Burgtonna, Grafentonna, Muhlhausen, and Weimar, Thuringia.

The *Helix terrena* of Clessin, which is so very common in the loess of South Germany, is only a slight modification from the type.

In France, according to Dr. Germain, it is one of the most characteristic species of the loess of the Rhône valley and elsewhere, and he cites it from the post-tertiary deposits of Pas-de-Calais; of Menchecourt, Somme; of Presle, Ain; of Dauphiné; of Toulouse, Haute Garonne; the tufa of Celle, Seine-et-Marne; and St. Pierre-lès-Elbœuf, Seine Inférieure.

M. Laville records it from the Pleistocene gravels of Champigny, Perreux, and Joinville-le-Pont, Seine.

It is also known from the loess of the department of the Rhône at St. Fons, St. Rambert l'Ile Barbe, Chartreux, Collonges, and St. Martin de Fontaines. In Isère in the loess of Bègude, Feyzin; in the Ain, near Tramoyes; and in the lacustrine marls of Gerland near Lyons.

Mr. F. W. Harmer records it from the *Limons grès à Succinées* of Normandy. The *Helix elisula* and *H. praviata* Locard are from the quaternary beds of Buisse, Isère, and according to Dr. P. Fischer *Helix locardiana* and *neyronensis* of Fagot, *H. stenoligma*, of Bourgt., and *H. elaverana* of Mabille, from the quaternary beds of Lyons, are all dismemberments from and referable to *H. hispida*.

In Austro-Hungary, it is recorded by Prof. Sandberger from Nussdorf near Vienna in valley loess of Lower and Middle Pleistocene age; and by Beyrich from that of Mogyoros near Gran, Hungary.

In Switzerland, Prof. Sandberger quotes it from Aargau in beds of Lower and Middle Pleistocene age; and Dr. Brockmann-Jerosch gives *H. sericea* Drap. as very common in the loess of the Rhine valley, St. Gall.

In India, it has been found in an interglacial deposit near the river Indus, at Kuardo, in Skardo, Cashmere, by Lieut.-Col. H. H. Godwin-Austen.

HOLOCENE.—In Somersetshire, Kennard and Woodward report it from an alluvial deposit at Castle Cary.

In Wiltshire, Rev. R. A. Bullen has found it at West Harnham near Salisbury.

In Dorset, Mr. Harold St. George Gray found the sub-var. *nana* commonly under the floor of the Roman arena and in other places during the excavations at Maumbury Rings. Dr. Blackmore has found it at Dewlish; and the Rev. R. A. Bullen at Durdle Barn Door.

In Isle of Wight, Prof. Forbes records it from the lacustrine beds at Totlands Bay; and Kennard and Woodward from St. Catherine's Down.

In Hampshire, Mr. J. T. Kemp found it very rare in the tufa of Test Valley at Mottisfont; also in the Itchen Valley; and Mr. C. Ashford in friable calcareous tufa at Twyford near Winchester.

In Sussex, Mr. J. P. Johnson found it at Brighton; and the Rev. E. S. Dewick at Eastbourne.

In Kent, it is recorded from the brick-earth of Rochester by Mr. J. Wilfrid Jackson; at Cuxton, Seal, Greenhithe, Farleigh, Ladywell, Exedown near Wrotham, and Otford, as common in Stanley's Quarry at the base of a grave of Romano-British age, and a single specimen in a deposit on Allen's Farm, Ightham, by Kennard and Woodward; from the base of a rainwash at Darenth by Mr. Kennard; from a deposit of Roman age at Barton Court, Dover, by Rev. R. A. Bullen; from Pegwell Bay by Mr. Alfred Bell; from the excavations at the Crossness Sewage Outfall, and from Erith Marshes by Mr. B. B. Woodward.

In Surrey, Mr. L. E. Adams found it abundantly to a depth of three feet in the Horseshoe Pit, Reigate; Mr. B. B. Woodward records it from Kew; R. H. Chandler from Walton Heath; and Kennard and Warren from Strand street, Bermondsey.

In Essex, Dr. H. Woodward records it from the shell-marl of the reservoir of the East London Waterworks, Walthamstow; Mr. W. M. Webb from deposits at Shalford; Kennard and Woodward from Ilford, Copford, Witham, Chignal, Raine, Tilbury, Braintree, and the Lea Valley; Mr. B. B. Woodward from Roxwell; and Mr. J. French from Felstead.

In Herts., Mr. C. Oldham found it common in molehills at Wilstone.

In Middlesex, Mr. J. E. Cooper records it from the excavations of the Gas Works, Staines; Kennard and Woodward from a deposit on the Thames bank near that town; they also record it from London Wall, and as the commonest Helicoid in the deposits at Uxbridge; and Mr. B. B. Woodward has recorded it from Blackfriars, Clapton, and the Docks.

In Berkshire, Kennard and Woodward record it from Wallingford and Newbury.

In Oxford, Kennard and Woodward record it from Clifton Hampden, and also from Caversham, and as found by Mr. J. Osborne White in marl on the Thames bank opposite Wargrave.

In Bucks., Mr. A. S. Kennard records it from Maidenhead; and Mr. J. E. Cooper from Boveney in the alluvial brick-earth and from the stratum beneath it, which is characterized by *Planorbis stroemi*.

In Norfolk, Kennard and Woodward record it from the Neolithic flint mines known as "Grimes graves," at Weeting near Brandon.

In Cambridge, Rev. O. Fisher found it in a Romano-British deposit near Butler's Spinney, Harlton.

In Gloucester, Hinton and Kennard tabulate it as found in the deposits on Cleeve Hill, near Prestbury; and Mr. H. Bolton as found at a depth of 44 feet in a deposit on Dumball Island, Avonmouth.

In Hereford, Boycott and Bowell record it as found by Mr. Ballard at Ledbury.

In Staffordshire, it has been recorded by Mr. H. Overton at a depth of four feet in company with the form known as *H. liberta* Westerlund at the Roman station of Letocetum, at Wall.

In Glamorgan, Mr. Clement Reid records its occurrence at Barry Docks, Cardiff.

In Lincoln, Mr. J. F. Musham found it at a deposit at Greetwell Iron Works.

In Leicestershire, it is recorded by Mr. Horwood from the alluvium exposed by the excavation for gasworks at Aylestone.

In Nottingham, Mr. Musson found it in the black-earth thrown up by moles at Bingham Moor, Gotham Moor, Scarthingmoor, Grassthorpe, and Egmanton; and Mr. Horwood in the alluvium of the River Devon, Vale of Belvoir, also in that of Car Dyke, and River Thirlbeck.

In Lancashire, it is recorded by Dean and Jackson from the shell deposits of Hawes Tarn, Silverdale; and by Mr. J. Wilfrid Jackson from below the foundations of the site of the old Roman fort in Collier street, Manchester.

In Yorkshire, Rev. E. Percy Blackburn records it as found by Mr. Mortimer in a "barrow" of "Bronze age" at Birdsall Brow, Driffield; Mr. Tom Petch records it from Hornsea; Dr. H. H. Corbett from an ancient lake-bed near Askern; and Mr. J. Wilfrid Jackson from Great Mitton and Clapham.

In Westmorland, Mr. J. Wilfrid Jackson records it from the deposit at Hale Moss.

In Fife, Dr. T. Scott records it from the deposit near Elie Railway Station.

In Galway, Mr. R. D. Darbishire found it in the old land surface, between layers of blown sand, at Dog's Bay, Connemara.

In Tipperary, the Rev. A. H. Delap found it in a marl deposit near Clonmel.

In Belgium, it is found abundantly in grey limestone at Orp-le-Grand, Brabant.

In Scandinavia, Dr. Nordmann records it as common in the Holocene of Sweden and Denmark; and Steenberg from the freshwater chalk beds Oxnebjerg, Jutland.

Variation.—*Hygromia hispida* varies greatly in size and shape, in the degree of contraction of the umbilicus, and in the density or sparseness of its hispid covering, and has on one or other of these variable characters been split up into quite a number of species; but the necessity for specific names for these forms has never been justified as yet by the demonstration of anatomical differences, and every purpose would be better served for the present by regarding such forms as varietal only, inasmuch as a varietal nomenclature, while emphasizing the differences that may exist, keeps prominent the relationship.

As so aptly remarked by the late Mr. Alder, whose judgment was so thoroughly sound in the perception of distinctive characters, "the great difficulty of distinguishing these hispid shells by any permanent character has induced us to consider them all as varieties of the same species, of which *H. concinna* and *H. sericea* Drap. form the two extremes."

As affecting the shape of the shell, Dr. Germain has declared that the effect of a very humid and relatively cold climate is shown in this species by the slow and very regular coiling of the whorls; while Mr. Searles Wood believed that a marshy habitat induces an elevated form of shell.

The pale peripheral zone is in a general way the only indication of the existence of a former scheme of spiral banding, but M. Picard alludes to a form from Abbeville, France, ascribed to this species, bearing a very narrow brownish band beneath the last whorl.

The degree of hispidity is in inverse ratio to the calcification of the shell and reflects the character of the environment, the very hispid shells usually showing a very feeble development of the apertural rib, and are always proportionately duller in colouring than the depilate forms.

Though isolated instances occur of hispid individuals inhabiting somewhat exposed and arid situations, thus apparently controverting its more general prevalence in shady and moist places in accordance with the principle that dense shade and a certain degree of moisture conduce to the development of a thick epidermal covering with a tendency to its chitinous prolongation into hair-like processes; while aridity and exposure always lead to a reduction in the thickness of the periostracum and the loss of any hirsute adornments, and frequently to several successive formations of the labial rib to the shell during its growth, traces of which are perceptible and persistent throughout after life.

Prof. Lessona has described and figured the Piedmontese varieties *ripularum*, *vulgaris*, *trochiformis*, *hemispherica*, *subcœlata*, and *subplebeia* in the Atti Acc. Scienze di Torino of 1879, but this work has not been available for examination, and it is probable that all the forms indicated could have been appropriately placed under some of the numerous names previously published.

The true position of *Helix sericea* var. *fontainei* Colbeau from the banks of River Dendre, Hainault, is very uncertain, being described as having its affinities with *H. occidentalis* Recluz, and to be quite different from the *H. sericea* of other localities.

The var. *sepulcrorum* of Westerlund from Christiania, Norway, and from an ancient burial-ground near Calmar, Sweden, which he had previously noted as a variety of *H. rufescens* and as *H. hispida* var. *montana* Westl., does not appear to differ markedly from the type form.

The *Helix terrena* Clessin is described as differing from the type by its smaller size, more risen spire, and narrower umbilicus, which expands at the last whorl. Four varieties have been described by the author, viz.:— Var. *major*, shell very widely umbilicated, diam. 8 mill., alt. 5 mill. Var. *minima*, diam. 5 mill. Var. *conica*, spire elevated, umbilicus wider, diam. 5 mill., alt. 4½ mill., and var. *anguste-umbilicata*, umbilicus narrow, diam. 5 mill.

Fitzinger, studying the group in Austria, distinguished as var. *draparnaudiana* the form described by Draparnaud as typical of the species, and noted its restriction to montane districts; the *H. hispida* of Schrank he named var. *schrankii*, and noted its occurrence about Brigittenau and Prater, and the *H. sericea* of Studer and Hartmann he established as var. *studeriana*, and recorded it as common on the plains.

VARIATIONS OF FORM OF SHELL.

Var. **depressula** Dum. & Mort., Moll. Savoie, 1857, pp. 47, 48.

Helix hispida var. *decora* Baudon, Catal. Oise, 1862, p. 23.
Helix hispida var. *depressa* Pascal, Moll. Haute Loire, 1873, p. 39.
Helix hispida var. *gyratus* Westerlund, Prodr. Moll. Europ., 1878, p. 50.
Helix hispida var. *calcica* Fagot, Mal. Quat. Lyon., 1879, p. 36.
Helix rufescens var. *putonii* Clessin, Ex. Fauna, 1884, p. 158.
Helix (*Fruticicola*) *fœni* Locard, Conch. Franç., 1894, p. 126.
Helix hispida var. *plana* Steenberg, Danmark Fauna Landsnegle, 1911, p. 97.
Helix hispida var. *depressa* Germain, Moll. Angers, 1903, p. 109.

SHELL large and widely umbilicated, spire very flat, and whorls regularly enlarging, mouth oval.

The var. **depressula** D. & M., s.s., is described as large, with a very flat or depressed spire, and an open umbilicus.

The sub-var. **depressa** Pascal is described as being as large as the type form, of a pale horny tint; very flat or depressed, and with a very open umbilicus. The var. *depressa* Germain is more depressed. Diam., 10 mill.; alt., 4–4¼ mill.

The sub-var. **decora** is subdepressed, thin, and semitransparent, only slightly hirsute, and possessing a rather wide umbilicus.

The sub-var. **calcica** is larger and more depressed than the type; the whorls also enlarge more quickly, and the umbilicus is slightly narrower.

The sub-var. **gyrata** has a hispid shell, a flat spire, wide umbilicus, and distinct labial rib. Diam., 10 mill.; alt., 4 mill.

The sub-var. **plana** has a quite flat spire.

The sub-var. **fœni** is described as of a reddish-horny tint, sometimes showing a paler peripheral zone; spire only slightly risen. Diam., 7–8 mill.; alt. 4⅔ mill.

FIG. 37.—*Helix fœni* Loc. (after Germain).

The vars. *depressa* and *subdepressa* Germain may be assigned to this form.

The var. *depressula* is in Savoy and Isère said to be a mountain form, and in the pine forests ascends to nearly 6,000 feet altitude, the shell becoming flatter and the umbilicus wider as the locality becomes more elevated.

Dumont & Mortillet regard the *Helix cælata* Studer as being only a strongly striate form of this variety.

The *H. rufescens* var. *putonii* of Clessin judging chiefly by specimens in my own collection, is certainly not a form of *H. striolata*, but belongs to the present species, where it is also placed by Dr. Westerlund.

ENGLAND.

Wilts. N.—Purton, April 1907 ! Rev. J. Going.

CONTINENTAL DISTRIBUTION.

Germany—Recorded as fossil by Sandberger from the Lower Pleistocene of Baden at Mosbach, and in deposits of Lower and Upper Pleistocene age at Weimar, Grafentonna, Burgtonna, and Muhlhausen, Thuringia.

In the Lower and Mid Pleistocene beds he cites it from Oberweiler, Sulzburg, Steinbach, and Oos, in Baden; from Oppenheim, Weilburg, and Wiesbaden, in Hesse Nassau; from Frankenhausen and Sondershausen, Thuringia; Priesa, Meissen, and Dresden in Saxony; from Passau, Bavaria; also at Nidda and Geisnidda in the Niddathal.

It is recorded by Herr von Ihering from tufa of Streitberg and Ober Zaunsbach, Franconia; and by Hesse from calcareous tufa and peat at Pyrmont.

France—The var. *depressula* is recorded by Dumont and Mortillet from Grande Chartreuse and other places in Isère, and from Mont Cenis, etc., in Savoy.

The sub-var. *depressa* Pascal is recorded by Pascal from Puy, Haute-Loire; and from the environs of Paris; the sub-var. *depressa* Germain as being quite gregarious about Angers, Maine-et-Loire; and the sub-var. *putonii* is quoted from the Vosges by Clessin.

The sub-var. *fœni* is rather common in France, and is specially recorded from about Angers, Maine-et-Loire, by Germain; and from the Meuse by Cardot.

Dr. Germain records it as common in the fossil state in the loess about Lyons; and Jodot from the tufa of Celle-sous-Moret, Seine-et-Marne.

The sub-var. *calcica* is only known in the fossil state, and is from the quaternary deposits near Lyons.

The sub-var. *decora* was found on a species of *Carex* in the Forest of Hez, Oise.

Belgium—The sub-var. *putonii* reported by Dr. Westerlund; and a "very flat" spired variety is recorded from Grez in Brabant by Raeymaekers and Loë.

Sweden—The sub-var. *gyrata* is recorded from Sweden by Dr. Westerlund.

Denmark—The sub-var. *plana* is recorded from Soro, Zealand, by Steenberg; the sub-var. *gyrata* is found at Klint, Isle of Moen.

Var. **globulosa** Dum. & Mort., Moll. Savoie, 1857, p. 47.

Helix hispida var. *conica* Jeffreys, Brit. Conch., 1862, i., p. 199.
Helix hispida var. *conica* Baudon, Catal. Moll. Oise, 1862, p. 24.
Helix liberta Westerlund, Moll. Suède et Norv., 1871, p. 54.
Helix hispida var. *conoidea* Broeck, Bull. Soc. Mal. Belg., 1871, p. xliv.
Helix hispida var. *septentrionalis* Clessin, Jahrb. Deutsch. Mal. Ges., 1874.
Helix hispida var. *subglobulosa* Locard, Mal. Lyonn., 1877, p. 43.
Helix (*Fruticicola*) *hispida* var. *falsani* Locard, Desc. Mal. Quat. Lyon, 1879, p. 35.
Fruticicola hispida var. *conica* Clessin, Exc. Moll. Fauna, 1881, p. 153.
Helix hispida var. *elevata* Williams, Midl. Nat., 1889, p. 193.
Helix (*Trichia*) *sericea* var. *subconica* Wattebled, Journ. de Conch., 1889, p. 323.
Helix (*Trichia*) *hispida* var. *perforata* Wattebled, Journ. de Conch., 1889, p. 324.
Helix hispida vars. *globosa* and *alta* Germain, Moll. Quat. Rhône et Rhin., 1912, p. 66.

The var. **globulosa** D. & M. is described as of an elevated, globose, and nearly trochoid form, with a narrow umbilicus.

The sub-var. **subglobulosa** of Locard is somewhat globose, clear horny yellow, and varies from 6–7 mill. in diameter.

The sub-var. **conica** Baudon is globose in shape, spire conical. Diam. 7 mill.; alt. 5–6 mill. The sub-var. *conica* Jeffreys is described as shell smaller, spire more raised. The sub-var. *conica* Clessin has 5–6½ whorls, the last expanded. Diam., 8 mill.; alt., 5 mill.

The sub-var. **subconica** Watt. is small, globose, conoid, whorls quite convex, thin, glossy, and without hairs in the adult, and links the variety with the type.

The sub-var. **conoidea** Broeck is conoid and very elevated.

The sub-var. **liberta** is narrowly umbilicate, and sparingly hirsute, or even smooth above. Diam., 6–7 mill.; alt., 4–5 mill. Though in recent years this form has been frequently referred to *H. sericea* Drap., yet such allocation was especially deprecated by its author Dr. Westerlund.

The sub-var. **septentrionalis** Clessin is described as possessing a narrower umbilicus and a more elevated spire. Diam., 9 mill.; alt., 4 mill.

The sub-var. **falsani** is distinguished from the type by its somewhat more globosely-elevated form and more distinct sutures.

The sub-var. **perforata** is relatively smaller and more globose, and is more narrowly umbilicate than the type, of a horny-fawn colour, with a broad whitish peripheral band, and is intermediate between *H. hispida* and *H. sericea*.

The vars. *globosa*, *subglobosa*, and *alta* Germain also probably belong here.

It is also, according to Searles Wood, the *Helix conoidea* of Sowerby (Mag. Nat. Hist., vii., p. 429, pl. 2, ff. 4, 5) from the fossiliferous beds of Clacton, Mr. Wood remarking that in marshy places *H. hispida* assumes an elevated form.

BRITISH ISLES.

This variety is known from the Channel Isles (according to Messrs. Tomlin and Marquand it is the prevailing form in the Isle of Alderney), Isle of Wight, Sussex, Norfolk, Derby, Nottingham, Lancashire, Yorkshire, and Durham. The sub-var. *conica* was found at Cane Hill, Surrey, by Mr. J. E. Cooper, and is recorded by Dr. Jeffreys from roots of *Rosa spinosissima* on sandhills near Swansea, **Wales.** In **Ireland,** Mr. L. E. Adams reports it as common about Coleraine, Londonderry.

CONTINENTAL DISTRIBUTION.

Germany—The sub-var. *conica* Clessin is reported from Westphalia by Mr. Gude; the sub-var. *septentrionalis* is known from Pyrmont, Corbach, Cologne, Breidenstein and Sternberg near Lemgo, Lippe Detmold.

Belgium—The var. *conoidea* in ditch, Sluys-Kill, Brabant.

France—The var. *globulosa* inhabits the lowland fields and roadsides in Savoy, and does not ascend beyond 1,350 feet; the sub-var. *conica* Baud. is very rare, and recorded from the Prairie d'Houdainville, Oise, by M. Baudon; the sub-var. *falsani* is found in the quaternary deposits about Lyons; the sub-var. *perforata* is said by Capt. Wattebled to occur at Auxonne, Côte d'Or, and to be common on the banks of river Loue in the departments of Jura and Doubs; and the sub-var. *subconica* rare about Auxonne and the wood at Flagey, Côte d'Or.

Norway—Miss Esmark records it from Bygdó near Christiania; and from Eker, Sandefjord, and Manger in the Bergen district.

Sweden—Recorded from Stockholm, Upsala, and Drottningholm; the sub-var. *septentrionalis* from Balteberga, Kinnekulle, and Skane; and sub-var. *liberta* from Lund in Skane.

Denmark—Found throughout the country, according to Dr. Westerlund; and the sub-var. *septentrionalis* from Fredriksdal, and at Aarhus in Jutland.

Siberia—Middendorff's Siberian specimens are regarded by Clessin as belonging to the var. *septentrionalis.*

Var. **pratensis** Baudon, Cat. Moll. Oise, 1862, p. 23.

Helix hispida var. *subangulosa* Sandberger, Vorwelt, 1875, p. 810.
Helix hispida var. *milleti* Germain, Moll. Angers, 1903, p. 109.

Slightly keeled at the periphery.

The sub-var. **subangulosa** Sandberger, which was not described, may probably be properly placed here.

The sub-var. **milleti** is thin, of a clear fawn or reddish colour, with a slight peripheral keel, most perceptible when young, with short stiff blackish hairs; peristome thickened. Diam., 5–10 mill.; alt., 3–5 mill.

CONTINENTAL DISTRIBUTION.

Germany—Dr. Sandberger alludes to a sub-variety *subangulosa* fossilized in the Lower Pleistocene sands of Mosbach, Durlach, and Bruchsal, Baden.

France—Var. *pratensis* in fields, especially at the foot of poplars, near Mouy, Oise (Baudon, l.c.). The sub-var. *milleti* is gregarious about Angers, Maine-et-Loire, on plants by the water, or amongst decayed leaves beneath trees.

VARIATIONS IN SIZE OF SHELL.

Var. **major** Sandberger.

Helix hispida var. *major* Sandberger, Vorwelt, 1873, pl. 36, f. 8 a, b, c.

The var. **major** is named and is figured without precise details and without description; the figure shows a shell over 10 mill. in diameter; the line indicating size is certainly quite incorrect.

Fig. 38.—*H. hispida* var. *major* Sandberger (after Sandberger).

BRITISH ISLES.

In **England,** Mr. L. E. Adams found specimens at Maidenhead, Berks., about 11 mill. diam.

CONTINENTAL DISTRIBUTION.

Germany—Sandberger cites many localities in the Lower and Middle Pleistocene for this variety, as Heidelberg, Durlach, Bruchsal, etc., in Baden; Frankenhausen and Sondershausen in Thuringia; Priesa and other places in Saxony, etc.

Switzerland—Sandberger gives as localities the Lower and Middle Pleistocene deposits at Aargau.

Sweden—Var. *major* recorded by Dr. Westerlund.

Var. **minor** Picard.

Helix hispida var. γ Draparnaud, Hist. Moll., 1805, p. 104, pl. vii., f. 22.
Helix hispida var. *minor* Picard, Moll. Somme, 1840, p. 228.
Helix hispida var *minor* Bourguignat, Mal. Alger., 1864, i., p. 169, pl. xvii., ff. 40-42.
Helix hispida var. *minor* Sandberger, 1873, Vorwelt, pl. 36, f. 10 a, b, c.
Helix hispida var. *nana* Jeffreys, Brit. Conch., 1862, i., p. 199.
Helix hispida var. *nitida* Baudon, Catal. Oise, 1862, p. 23.
Helix terrena Clessin, Jahrb. Mal. Ges., 1874, p. 331, pl. 13, f. 4.
Helix hispida var. *tardigyra* Westerlund, Verh. Zool.-Bot. Ver. Wien, 1892.

SHELL smaller than type; diameter not exceeding 6 mill. This variety, which is said to have a stronger labial rib in proportion to the reduction in size of its shell, is seldom very hispid.

The var. **minor** Picard s.s., is described as conoid, very small (5 mill. diam.), rather thick, perforate umbilicus, and with a rib or tooth about a millimetre long at the angle of the columella. The var. *minor* of Bourguignat is 6–9 mill. in diameter and 4–6 mill. in altitude. The var. *minor* Moquin-Tandon has the shell much smaller, more depressed and white, and is identical with the var. γ Draparnaud. The var. *minor* of Sandberger is figured, enlarged, and is described as 5¼ mill. in diameter and 3½ mill. in altitude. The var. *minor* of Pfr. is depressed; diam. 6½ mill., alt. 3½ mill. The var. *minor* Germain of same form, but darker; diam. 5–5½ mill., alt. 3 mill.

FIG. 39.—*H. hispida* v. *minor* Sandberger (after Sandberger).

The var. **nana** Jeffreys has the shell much smaller, but with a strong labial rib, spire depressed. Diam., 5 mill.; alt. 2½ mill.

The sub-var. **nitida** is 5–6 mill. in diam., and 4–4½ mill. in alt., glossy, solid, of a transparent clear fawn, scarcely hispid, and the labial rib visible outwardly.

The sub-var. **terrena** is small, globose, and somewhat thick-shelled. Diam., 5·3 mill.; alt., 4·5 mill.

The sub-var. **tardigyra** Westl. has a funnel-shaped umbilicus, closely coiled whorls, and a labial rib fairly well defined basally. Diam., 6 mill.; alt., 4 mill.

FIG. 40.—*Helix terrena* Clessin (after Clessin).

BRITISH ISLES.

In the **British Isles**, it is not common; it is, however, plentiful and very characteristic on Afton Down, Freshwater, and Boniface Down, Ventnor, in the Isle of Wight; and has been reported from Wiltshire, Hampshire, Somerset, Sussex, Kent, Norfolk, Gloucester, Glamorgan, Pembroke, Lincoln, Derby, Yorkshire, Westmorland, and Northumberland.

In **Scotland**, it is recorded from Haddington and Fifeshire.

CONTINENTAL DISTRIBUTION.

Germany—As a fossil it is recorded by Dr. Sandberger from the Lower and Middle Pleistocene deposits of Germany, at Durlach, Achern, Steinbach, and Oos in Baden; Cannstadt, Neckarelz, etc., in Wurtemburg. Reported by Clessin from "Mid-Germany," and the *H. terrena* from the older loess of Heidelberg, etc. The sub-var. *tardigyra* from Vegesack by Staudinger.

Belgium—M. Colbeau reports it from Furnes and Nieuport in West Flanders; and from Brussels and Louvain in Brabant.

France—Recorded by M. Cardot as very rare at Deville, Ardennes; by M. Picard from the Somme; by Mr. Oakeshott for the Alpes Maritimes; by Dr. Jeffreys for Pas-de-Calais; by M. Pascal from Haute Loire and the department of the Seine; by M. Taslé from Morbihan; and by Dr. Germain from Sorges, Maine-et-Loire.

The sub-var. *nitida* is rare on *Allium* on the marshy ground in the forest of Fourneau, Mouy, Oise (Baudon, l.c.).

Austro-Hungary—Reported by Dr. Staudinger from the Tyrol.

Sandberger records fossil specimens from the Lower Pleistocene of Nussdorf near Vienna, with a tooth-like thickening on the basal margin of the apertural rib.

Norway—Noted by Miss Esmark from the neighbourhood of Christiania.

Sweden—Var. *minor* recorded by Dr. Westerlund. Sub-var. *tardigyra* from Othem, Gothland, and Lund in Skane.

Algeria—M. Bourguignat records his var. *minor* as rare near Mostaghanem, but his range of size includes the typical form.

VARIATION IN COLOUR OF SHELL.

Var **albida** Jeffreys.

Helix hispida var. *pallida* Picard, Moll. Somme, 1840, p. 228.
Helix concinna var. *albida* Jeffreys, Brit. Conch., 1862, p. 198.
Helix hispida var. *albida* Jeffreys, op. cit., p. 199.
Helix hispida var. *albina* Westerlund, Moll. Suède et Norvége, 1871, p. 52.
Helix hispida var. *nebulata* Westerlund, Prodr. Moll. Eur., 1878, p. 49.
Trichia hispida var. *albina* Esmark, Journ. of Conch., 1886, v., p. 126.

SHELL white.

The var. **albina** Westerlund is described as hyaline and densely hispid.

The sub-var. **nebulata** is, according to Herr Clessin, a small depressed whitish form, linking the var. *albida* with the type.

The *H. villiersii* de Malzine is regarded by Van den Broeck as the albine form.

The *Helix hispida* var. *albida* s.s. of Jeffreys and the *H. hispida* var. *pallida* of Picard, Westerlund and Steenberg, include both white and pale horny shells, and are therefore only partially referable to this form.

BRITISH ISLES.

This form is widely dispersed throughout the geographical range of the species, and though usually occurring sporadically, is yet frequently found in colonies almost exclusively consisting of the variety.

Occasionally shells are found which are only partially albine, the earlier growth being usually normal and the later growth becoming suddenly albine.

CONTINENTAL DISTRIBUTION.

Germany—Found in Georgenthal, Thuringia, by Mr. F. H. Sikes; in Saxony by Schmidt; in Baden by Gysser; and at Rödding, Schleswig, by Mr. H. Schlesch.

The sub-var. *nebulata* is recorded from North Germany by Dr. Westerlund.

Belgium—The sub-var. *nebulata* recorded by Dr. Westerlund.

France—Recorded from around Paris by M. Pascal; the sub-var. *pallida* from the Somme by M. Picard; and sub-var. *nebulata* from France by Dr. Westerlund.

Switzerland—Found at Lucerne by Mr. Hugh Watson.

Norway—Miss Esmark records the var. *albina* from Krokkleven and Ringerige, near Christiania.

Sweden—The sub-var. *albina* is recorded from near Christianstad, from Skane, and the Island of Oland; and the sub-var. *nebulata* from Kinnekulle by Westerlund.

Denmark—Recorded for the Isle of Bornholm by Mr. H. Schlesch; and the sub-var. *nebulata* by Dr. Westerlund from the same island.

Var. **rosea** Broeck.

Helix depilata var. *rosea* Broeck, Proc. Soc. Mal. Belg., 1872, vol. vii., p. lxiii.
Helix vendeana Letourneaux, Moll. Vendée, 1869, pp. 17, 18.

SHELL of a rosy-brown colour.

This variety in the original locality is also stated to be strongly pubescent; the shell to be more elevated and fragile and the mouth rounder with a stronger white basal rib than in the type, and hardly showing a trace of the pale peripheral zone.

The **Helix vendeana** Letourneaux would appear to be perhaps most suitably placed with this variety, chiefly on account of the vinous tint of its shell, though also agreeing in its pubescent surface and rounded whorls. It is stated to be intermediate between *H. hispida* and *H. concinna*, and to be moderately abundant in the Bois-Plat near Fontenay, Vendée, France.

England—Mr. Tom Petch collected the dark red form at Lynn, Norfolk.

Ireland—The same variety is recorded by Messrs. Welch and Stelfox as common on grassy ledges under the cliffs at the caves, Gleniff, and a few at Glencar, Sligo; a similar form was found by Mr. W. F. de Vismes Kane at Glen Druid, near Carrickmines, Dublin.

Belgium—Var. *rosea* Hastière, Namur, May 1872 (Broeck, l.c.).

Var. **fusca** Moquin-Tandon.

Helix hispida vars. *fusca* and *cornea* Moquin-Tandon, Hist. Moll., 1855, p. 224.
Helix (*Trichea*) *sericea* var. *fusca* Wattebled, Journ. de Conch., 1889, p. 323.

SHELL of a clear brown or horny tint.

The var. **fusca** Moq.-Tand., s.s., is described as of a clear brown; the var. *fusca* Wattebled is thin and of a very dark horny-fawn colour; the var. *fusca* Westerlund is described as "dark brown."

The sub-var. **cornea** is described as of a pale horn colour.

Westerlund describes vars. *cornea* and *fusca* as never of a rufous-brown colour.

ENGLAND.

York S.E.—Var. *fusca* Moq., Wressle, G. Roberts.
Lancashire S.—Var. *fusca* Moq., Read, near Burnley ! R. Standen.
Lancashire Mid—Var. *fusca* Moq., Grimsargh near Preston ! W. H. Heathcote.

SCOTLAND.

Cantire—Var. *fusca* Moq., Campbeltown, 1888 ! Alex. Shaw.

CONTINENTAL DISTRIBUTION.

France—Var. *fusca* Moq. is cited as rather rare about Lyons in the Rhône and Saône valleys by Locard, and by Pascal as occurring in gardens of the Grand Montrouge, Orly, Choisy-le-Roi, Villiers-sur-Marne, etc., in the environs of Paris. The sub-var. *fusca* Wattebled is common on the ramparts of Auxonne, Côte d'Or. The sub-var. *cornea* is recorded as rare on the mountains of the Bugey and the Colombier, Ain, by Locard; the var. *fusca* and sub-var. *cornea* from Hérault by Dubrueil; and by Pascal from Arcueil-Cachan and gardens of Grand Montrouge in the environs of Paris.

VARIATIONS IN CHARACTER OF SHELL.

Var. **albocincta** Taylor.

SHELL showing a pale and somewhat more heavily calcified peripheral band.

This variety, which is probably atavic, retains the calcified area separating the upper and lower group of bands probably existent in the ancestral form. It is perhaps more frequently found in the more remote or isolated parts of its natural range than in its assumed area of origin, and this is rendered more probable as Prof. E. von Martens, of Berlin, in alluding to the reported occurrence of pale-banded specimens of *H. hispida*, remarked that he knew of no banded *H. hispida*.

In the **British Isles** it has been recorded from Somerset, Suffolk, Cambridge, Lincolnshire, and Derbyshire in England; Perthshire in Scotland; and Dublin, Meath, Louth, Londonderry, and Kildare in Ireland.

On the **Continent** it has also been found by Mr. L. E. Adams at Libau, Courland, Russia; and it is also, according to M. Mortillet, the *Helicella prevostiana* of Risso, from the Alpes Maritimes, France.

Var. **mörchi** Westerlund, Fauna Binnenconch, Suppl., 1890.

SHELL spirally lineate beneath.

Iceland—In gardens, Thorshamn (Westl., Syn. Moll., 1897, p. 49).

Var. **sericea** Draparnaud (not Jeffreys).

Helix sericea Draparnaud, Tabl. Moll., 1801, p. 85.
Helix hispida var. *subglobosa* Jeffreys, Brit. Conch., 1862, p. 199.

The var. **sericea** Draparnaud is described as somewhat globose, subdepressed, clear horn colour and yellowish, thin, transparent, slightly carinate, very lightly striate, clothed with long yellowish recurved hairs. Spire $4\frac{1}{2}$–5 gradually increasing whorls; aperture lunate, higher than broad; peristome simple, or with a very slight internal rib, which is visible through the shell as a yellowish band; the peristome slightly reflected around the very narrow umbilicus.

The sub-var. **subglobosa** Jeffreys is described as more globular, much thinner, horn colour or white, and umbilicus very small.

Though *H. sericea* Drap. is figured by Lehmann as differing from *H. hispida* in possessing tricuspid median teeth, while those of *H. hispida* are shown as unicuspid only, yet this assumed difference is probably founded on some error, as British specimens do not show this divergence.

BRITISH ISLES.

It has long been known that the shell bearing this name abroad is a widely distributed inhabitant of the British Isles, and has also from time to time been published by successive English conchologists as a new discovery and as a member of or an addition to our fauna, but no convincing evidence has as yet been adduced by any of its sponsors to substantiate the distinction claimed for it.

In a fossil state it is recorded from the Pleistocene deposits of Barnwell Abbey, Cambridge; Swanscombe, Kent; and Copford, Essex. It also occurs in the Holocene deposits of Uxbridge and Staines, Middlesex; Walthamstow, Chignal, and Ilford, Essex; Greenhithe in Kent; Westbury in Gloucester; Clifton-Hampden in Oxfordshire; and Knettishall in Suffolk.

In a recent state it is widely distributed through the continent, and is found in the Balkan peninsula, but precise records are not always available.

CONTINENTAL DISTRIBUTION.

Germany—Recorded as living in Alsace, Baden, Brandenberg, Holstein, Nassau, Prussia East, Posen, Reuss, Saxony, Silesia, Suabia, Thuringia, and Wurtemberg.

France—Known to occur throughout the country, and has been especially noted from Ain, Aisne, Alpes Maritimes, Ardennes, Aube, Basses Pyrénées, Charente Inférieure, Gard, Gironde, Lozère, Morbihan, Nord, Savoy, Seine, Seine-et-Marne, Vienne, Vaucluse, and Yonne.

Austro-Hungary—Reported from Austria, Bohemia, Carinthia, Carniola, Galicia, Hungary, Styria, and Tyrol.

Switzerland—Only recorded from Aargau, Appenzell, Basel, Berne, Grisons, Lucerne, Neuchâtel, and Valais.

Italy—Recorded from Lombardy, Piedmont, and Venetia.

Spain—Catalonia, Galicia, and the South Pyrenean slope.

Russia—Known from the Crimea and the Caucasus.

Siberia—Recorded from Irkutsk and the valley of the Amur.

North Africa—Bourguignat records it from Algeria.

Var. **hispidosa** Mousson, Coq. Schlafli, 1863, vol. ii., p. 25.

Helix fœni var. *hispidula* Germain, Moll. Angers, 1903, p. 110.

SHELL globose, narrowly umbilicated, and densely hispid.

The sub-var. **hispidula** Germain has the hairs particularly numerous, very fine and persistent, having a soft and woolly aspect.

This is the form which was formerly considered as the type of the species, but which is now superseded by Jeffreys' var. *concinna*, in accordance with the character of Linné's type shell in the possession of the Linnean Society.

The *Helix hispidosa* Bourguignat, Proc. Soc. Nat. Hist. Toulouse, 1879, p. 19, is not this form, but related to or identical with the var. *depilata* Alder.

In the **British Isles** it is widely distributed within the range of the species, but is more especially found in shady places.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *hispidula* is recorded as rare about Angers, Maine-et-Loire, by Dr. Germain.

Russia—Known from many points in the Caucasus; also in Western Transcaucasia; and Mr. L. E. Adams found it at Libau in Courland.

Var. **depilata** Alder.

Helix depilata Alder, Mag. Zool. and Bot., 1837, ii., p. 107.
Helix hispida var. β Draparnaud, Hist. Moll., 1805, p. 104, pl. vii., f. 21.
Helix hispida var. *subrufa* Moquin-Tandon, Hist. Moll., 1855, ii., p. 224.
Helix hispida var. *subrufa* Jeffreys, Brit. Conch., 1862, i., 199.

SHELL almost or entirely destitute of epidermal hairs, labial rib developed.

The sub-var. **subrufa** Moq. is described as more solid, smooth and reddish, and the sub-var. *subrufa* Jeffr. as reddish-brown, more solid, with a strong labial rib.

This form, which is probably identical with the *Helix depilata* of Pfeiffer, as was believed by Mr. Alder, was first indicated and described by Draparnaud, and is said by Dr. Jeffreys to be "not uncommon in dry situations."

In the **British Isles** it is widely distributed, and has been reported in **England** from Cornwall, Devon, Somerset, Dorset, Hampshire, Wiltshire, Sussex, Surrey, Bedford, Leicester, Norfolk, Suffolk, Gloucester, Hereford, Stafford, Northampton, Derby, Nottingham, Lincoln, Cambridge, Cheshire, Leicester, Lancashire, Yorkshire, Westmorland, and Cumberland.

Distribution of *Hygromia hispida* (L.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lanes.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

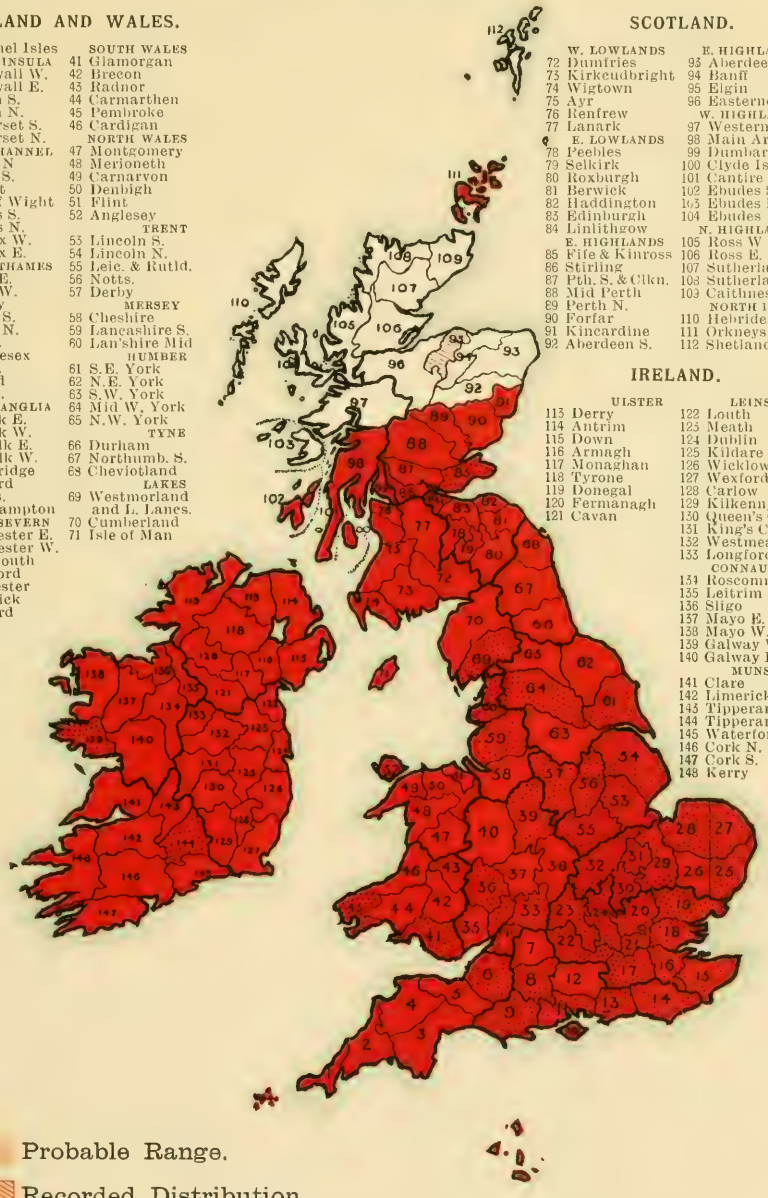
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

Wales—Recorded from Pembroke, Merioneth, and Denbigh.

Scotland—Lanark, Renfrew, Main Argyll, Dumbarton, Perth, and Forfar.

Ireland—Noted from county Leitrim.

CONTINENTAL DISTRIBUTION.

Germany—Found at Triberg by Mr. F. H. Sikes and recorded from Mannheim, Baden, by Mr. Daniel; and from Nassau by Dr. Kobelt. The *Helix depilata* C. Pfr. is recorded from Cassel and from the Kratzenberge by its author; and by Dr. L. Pfeiffer from Heidelberg.

France—Dr. Grateloup cites this form as inhabiting the centre, north, and west of France; M. Cardot as common in the Ardennes; Dumont and Mortillet for Savoy; Capt. Wattebled from Côte d'Or; M. Locard from the Ain; de l'Hopital from Calvados; M. Clement from the Gard; and Mr. E. Collier from the Jura.

The sub-var. *subrufa* from Morbihan by Taslé; and from Herault by Dubrueil.

Switzerland—M. Charpentier quotes var. *depilata* from St. Maurice, Valais.

Norway—The var. *depilata* is recorded from about Christiania by Miss Esmark.

Sweden—Dr. Westerlund records its presence at Lund and Christianstad, Skane.

Denmark—Recorded from Veile, Jutland, by Dr. Westerlund; and by Steenberg from near Copenhagen.

Russia—*Helix depilata* is cited for Kursk by Krynicki.

MONSTROSITIES.

Monstr. **sinistrum** Baudon, Cat. Oise, 1862, p. 24.

SHELL reversed in coiling.

ENGLAND.

Cambridge—A specimen is recorded by Dr. Jeffreys as found by Rev. E. S. Dewick in a post-tertiary deposit near Cambridge.

Berwick—A specimen of the openly umbilicated form found by Mrs. Carphin at Coldingham near Eyemouth!

CONTINENTAL DISTRIBUTION.

France—Recorded by Norguet from Avesnes, Nord; by Dr. Baudon from the Prairie de Moineau, near Mouy, Oise; and by Locard as very rare in the alluvium of the Rhône to the north of Lyons in the department of the Ain.

Belgium—Recorded by M. Roffiæn from the left bank of the Meuse, between Waulsort and Hastière in the province of Namur.

Monstr. **scalaroides** Baud., Cat. Oise, 1862, p. 24, & J. de Conch., 1884, pl. ix.

More or less scalariform. Dr. Baudon describes his type specimen as having the first three whorls obliquely inclined to the axis, and almost detached from the fourth whorl, which surmounts but is sharply separated from the body whorl, appearing like two shells of unequal size superposed.

ENGLAND AND WALES.

Kent W.—A characteristic specimen found by Mr. J. Stacey, at Stony Hill Wood, May 1894, is now in the collection of Mr. A. S. Poore.

Cheshire—Marple Woods, J. Wilfrid Jackson.

Cumberland—Ireby, three specimens, April 1910, W. J. Farrer.

Isle of Man—Niarbyl, Aug. 1893, R. Cairns.

CONTINENTAL DISTRIBUTION.

France—Recorded by Moquin-Tandon from Paris; and by Dr. Baudon from Prairie de Moineau, Oise.

Geographical Distribution.—*Hygromia hispida* is widely dispersed throughout Central Europe, and extends as far as the Ussuri and Amur Valleys in the extreme east of Asia, and has been carried by commerce and become established in North America.

FIG. 41.—*Helix sericea* Drap. natural size and enlarged (after Draparnaud).

Under the name of *Helix sericea* Draparnaud, it is probably more widely known throughout the continent than the typical *H. hispida*, of which it is a thinner, more globose, more hispid, and more narrowly perforate form. It has been and still is a source of much confusion to systematists, Dr. Jeffreys at one time even considering it as synonymous with the differently organised *H. granulata* Alder.

In the British Isles it is well diffused over England, Wales, and Ireland, and extends over the southern half of Scotland, but is quite unknown beyond, except that Mr. A. W. Stelfox has reported his discovery of the species at Stromness in the Orkney Islands. Its occurrence there may be regarded as correlated with its presence in Iceland and the Faroes.

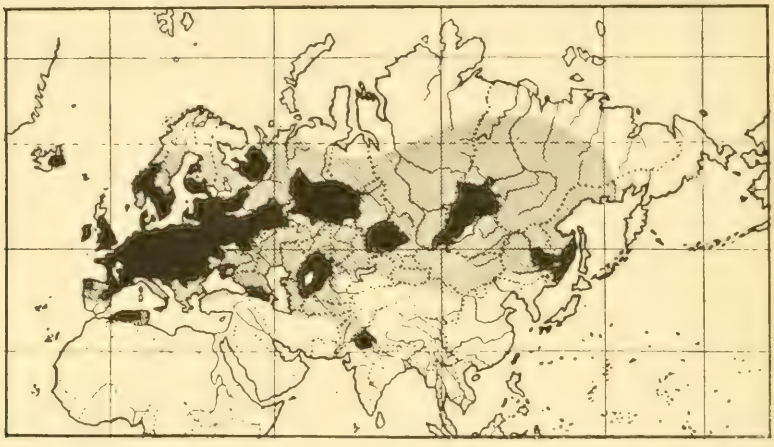


Fig. 42.—Geographical Distribution of *Hygromia hispida* (Linné).

Probable Range Recorded Distribution

GERMANY.

H. hispida has been recorded under that name from Alsace, Baden, Bavaria, Brandenburg, Bremen, Darmstadt, Franconia, Gotha, Hanover, Hesse-Cassel, Holstein, Lippe-Detmold, Lorraine, Lüneberg, Lusatia, Magdeburg, Mecklenburg, Merseburg, Nassau, Oldenburg, Osnabruck, East, West, and Rhenish Prussia, Pomerania, Posen, Pyrmont, Reuss, Saxony, Schleswig, Silesia, Suabia, Thuringia, Weimar, Westphalia, Wurtemburg, and the Islands of Heligoland, Usedom, and Rugen.

NETHERLANDS.

Holland—Known from Friesland, Gelderstein, North and South Holland, Limburg, Utrecht, and Zealand.

Belgium—Throughout the kingdom, and records are known for Antwerp, Brabant, Flanders West, Hainault, Liége, Limburg, Luxemburg, Namur, and the Grand Duchy of Luxemburg.

FRANCE.

As *H. hispida* it has been generally spoken of as inhabiting all or almost all France, and has been specially noted from Ain, Aisne, Allier, Alpes Maritimes, Ardennes, Ardèche, Ariège, Aube, Aude, Auvergne, Aveyron, Basses Alpes, Basses Pyrénées, Bouches-du-Rhône, Calvados, Champagne Meridionale, Charente Inférieure, Cantal, Côte d'Or, Côtes-du-Nord, Drôme, Eure, Eure-et-Loir, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Hautes Pyrénées, Haute Savoie, Herault, Ille-et-Vilaine, Indre, Indre-et-Loire, Isère, Jura, Landes, Loire Inferièure, Loiret, Lorraine, Lozère, Maine-et-Loire, Manche, Morbihan, Meuse, Moselle, Nièvre, Nord, Oise, Orne, Pas-de-Calais, Puy-de-Dôme, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy, Seine, Seine Inférieure, Seine-et Marne, Seine-et-Oise, Somme, Var, Vaucluse, Véndee, Vienne, Vosges, Yonne, and the Island of Corsica.

ITALY.

Recorded by Prof. Lessona from Piedmont; by Adami and Pini from Lombardy; by Strobel from the north slope of the Appenines in Emilia; it is also reported from Venetia and the province of Catangaro, Calabria, by Mr. G. K. Gude, though not included by Marchioness Paulucci in her Malacological Fauna of Calabria; and specimens labelled "Sicily" are in the University Museum, Manchester.

SPAIN.

Confined to the north of the country, and recorded from Catalonia, Galicia, and Aragon, by Prof. Hidalgo.

AUSTRO-HUNGARY.

Distributed throughout the empire, being recorded from Austria, Bohemia, Bosnia, Carinthia, Carniola, Croatia, Galicia, Goritz, Hungary, Illyria, Moravia, Silesia, Slavonia, Styria, Tyrol, Transylvania, and Vorarlberg.

SWITZERLAND.

Probably found throughout the country, and has been recorded for Appenzell, Aargau, Basel, Berne, Geneva, Grisons, Lucerne, Neuchâtel, Schwyz, Solothurn, St. Gall, Uri, Valais, and Vaud.

BALKAN PENINSULA.

Roumania—Recorded from Brostheni in Moldavia by Clessin.

Servia—Recorded by Moellendorff from Kosljanske Stene.

SCANDINAVIA.

Norway—Very common in places, as about Christiania, Christiansand, and Bergen, but not extending beyond 63½ deg. north lat.

Sweden—Common in the southern provinces, but not extending beyond 60 deg. north lat. It is recorded from Christianstad, Malmohus, Goteborg, and found also in Jönköping, Smaland, Varmland, Blekinge, Nerike, Uplandia, Westergötland, Westmanland, etc., also on the Islands of Gothland and Oland.

Denmark—Found throughout the kingdom, and also in the Faroes, the Isle of Bornholm, and Iceland.

RUSSIA.

Probably dispersed over the western, southern, and central parts, extending to 62 deg. north latitude, and has been specifically recorded from Archangel, St. Petersburg, Caucasus, Courland, Esthland, Finland, Kaluga, Kharkov, Kursk, Lithuania, Livland, Moscow, Nijni-novgorod, Perm, Podolia, Poland, Smolensk, Taurida, Tchernigov, Vladimir, Volhynia, and Tiflis in Transcaucasia.

SIBERIAN SUB-REGION.

Siberia—Recorded by Middendorff from Beresov, Tobolsk; and Barnaul, Tomsk; by Maack from Irkutsk; by Gerstfeldt from the Issuri valley; by Mr. G. K. Gude from the Altai Mountains and Aral region; and by Dr. Germain from the Amur.

ASIA MINOR.

Armenia—Recorded by Dr. C. A. Westerlund as having been found in Armenia.

NORTH AFRICA.

Algeria—M. Bourguignat records it as rare under stones at foot of trees near Mostaghanem.

ATLANTIC ISLES.

Azores—Recorded by Dr. Gwyn Jeffreys on the authority of Gerstfeldt.

Madeira—Erroneously given by Dr. Jeffreys as Madeiran, owing to his misapprehension of Lowe's Index.

Canary Isles—Found at Las Palmas, Gran Canary, by Capt. W. J. Farrer.

NEARCTIC REGION.

Canada—Recorded by Dr. Pilsbry from Montreal, province of Quebec, and from Halifax, Nova Scotia.

United States—Mr. J. H. Thomson recorded receiving specimens from near Gay Head, on the Island of Martha's Vineyard, Massachusetts, which differed only from European specimens in being "thinner and lighter."

ORIENTAL REGION.

Kashmir—Godwin-Austen found fossil shells in an alluvial deposit of probably interglacial age near the Indus river, at Kuardo, in Skardo.

Hygromia revelata (Michaud).

1831 *Helix* (*Helicella*) **revelata** Michaud, Compl., p. 27, pl. 15, ff. 6–8.
1839 — *subvirescens* Bellamy, Nat. Hist. South Devon, p. 418, pl. 18.
1840 — (*Hygromanes*) *revelata* Gray's Turton's Manual, p. 142, pl. 11, f. 133.
1841 — *subviridis* Bellamy, British Association Report.
1855 — *occidentalis* Moq.-Tand., Hist. Moll., p. 221, & pl. 17, f. 10–13, not Recluz.
1889 — (*Zenobia*) *revelata* Paetel, Catal., p. 177.
1890 — (*Trichia*) *revelata* Westerlund, Catal. Reg. Palæarct., p. 23.
1906 — (*Capillifera*) *revelata* Honigmann, Beitr. zur Moll., p. 190.
1837 *Helicella revelata* Beck, Index Moll., p. 7.
1858 **Hygromia** *revelata* H. and A. Adams, Gen. of Moll., p. 215.
1860 *Fruticicola* (*Eulota*) *occidentalis* von Martens, Albers, Heliceen, p. 103.

HISTORY.—*Hygromia revelata* (*revelata*, discovered) was first noticed with certainty by Lieut. André Louis Gaspard Michaud, who in his Supplement to the work of Draparnaud described and figured the species, which is here associated with its distinguished author.

The *Helix revelata* previously mentioned by Férussac, was apparently neither described nor figured and according to Dr. Gwyn Jeffreys was based upon specimens of *Helix granulata* from Angers and Paris; while Mabille was of opinion that Férussac's *Helix revelata* was probably a young *Helix incarnata* or *H. strigella*, but M. Michaud was a contemporary of Baron Férussac, and believed the species of Férussac to be identical with his own.

Moquin-Tandon regarded his *Helix occidentalis* to be that of Recluz and consequently the same as *H. ponentina* of Morelet, as Recluz never described his species, the name being simply one he suggested to supersede that of *ponentina*, on the ground that Morelet's name did not conform to the accepted rules of nomenclature. Moquin-Tandon also believed his species to be identical with *Helix revelata* Michaud, but he regarded the *H. revelata* of Férussac and Bourguignat as distinct therefrom.

Dr. L. Germain on the contrary considers the *Helix revelata* of Férussac and Bourguignat as quite identical with *H. occidentalis* of Moquin-Tandon but as specifically different from both the true *occidentalis* Recluz, and the *Helix revelata* Michaud, referring the latter species to *H. montivaga* Westld. a globose shell with a white peripheral zone bordered on each side with brown. Dr. Germain and other French authors do not, however, appear to be well acquainted with *H. montivaga*, as they ascribe that name to a different form which may well be the *Helix revelata* as usually understood.

Abbé Dupuy who examined many Portuguese specimens of *H. ponentina* received from M. Morelet, is emphatic that they are identical with French specimens of *Helix occidentalis* and M. Morelet himself had not the least doubt that his *Helix ponentina* was quite the same as *Helix revelata* Fér.

The description of *H. occidentalis* given by Dr. L. Pfeiffer and based on specimens in the Cuming collection would seem to refer to *H. ponentina* as described by Morelet or may be allied to or identical with *Helix montivaga* Westl., to which the *H. lisbonensis* Pfr. probably also conforms.

A study of the original figures and description of *Helix ponentina* Morelet leads, however, to the view that possibly two species are confused together, the one to which the figures and the greater part of the description applies being evidently not the British *H. revelata*, but a globose spirally-banded shell with a thick, white and reflected lip, closely related to *H. montivaga*, a species described by Dr. Westerlund from specimens he found intermixed with a number of shells sent to him as *H. ponentina* by M. Morelet.

I therefore separate *Helix ponentina* Morelet, *H. occidentalis* Recluz, and *H. lisbonensis* Pfr. from *Hygromia revelata*, but tentatively admit *H. occidentalis* Moq., pending confirmation or otherwise of the published anatomical differences.

In 1827 Capt. Thomas Brown in his Illustrations of British Conchology described a *Vitrina membranacea* based upon specimens found on the Lomond Hills, Fifeshire, and which in the later editions of his work he regarded as identical with *H. revelata*, but authors now more correctly refer it to *H. fusca*.

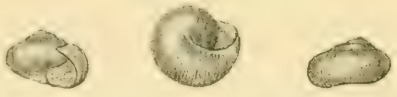


FIG. 44.—*Helix fusca* Mont., figured as *Helix revelata* by Capt. Brown (after Brown).

The honour of adding this species to the British fauna has been very generally accorded to Prof. E. Forbes, who found specimens on the Island of Guernsey, but that honour probably really belongs to Mr. J. C. Bellamy, who found specimens at Mevagissey, in Cornwall, and published under the name of *Helix subvirescens* a description and figure in 1839, and mentions that a Mr. Colley had previously found two dead shells, which he had referred to *Helix subrufescens*, a synonym of *H. fusca* Montagu.

Diagnosis.—*Hygromia revelata* differs from *H. hispida* in its smaller size, more globose shape, greenish colour, rounder mouth, and the number and length of the periostracal hairs.

From *H. fusca* it is separated by its smaller shell, the distinctly hairy investment, and the much more open umbilicus.

INTERNALLY, it is separated from *H. hispida* by the vestigial dart sacs, the swollen vagina, and the enlarged median part of the penis sheath.

H. fusca differs by having only a single dart sac and accessory gland, by the long whip-like flagellum, and by the very elongate spermatheca.

Original Description.—*Helix* (*Helicella*) *revelata* De Fér., Prod. page 44, no. 273. Coquille: Orbiculaire, presque globuleuse, légèrement striée, perforée, très-mince et légère, diaphane, luisante, d'un vert-pâle, hispide, poils rares, courts et jetés irrégulièremente sur l'épiderme; cinq tours convexes, le dernier plus grand relativement aux autres; ouverture ronde; péristome simple et tranchant; sommet mameloné. Hauteur 1½ à 2 lignes. Diamètre 3 lignes.

FIG. 45.—*H. revelata* Mich. (after Michaud).

Cette coquille très-voisine de l'*helix sericea* Drap. s'en distingue par sa taille plus petite, l'ouverture de son ombilic qui est plus large, par sa couleur plus foncée, son ouverture plus arrondie. Notre espèce est plus transparente, sa spire est moins élevée et sa suture plus profonde; la disposition, le nombre et la longueur de ses poils sert surtout à faire reconnaître l'espèce de Draparnaud.

Habite: (les environs de Paris et d'Angers, De Férussac). Les valons des Alpes. Elle est rare (Mon Cabinet).—MICHAUD, Complement, 1831, p. 27.

Description.—The ANIMAL of a Guernsey specimen had a pale translucent yellowish-grey BODY, becoming darker grey above, the dorsum sparsely covered with irregularly shaped TUBERCLES, which become more rounded on the sides, giving the surface a granular appearance and showing in some lights faint longitudinal lineation, but the transverse furrows described by Dr. J. Gwyn Jeffreys were not detected, while the RETRACTORS are perceptible through the skin as dark subdorsal bands on each side of the body; the DORSAL GROOVES not distinct and enclosing a row of ill defined elongated tubercles; OMMATOPHORES rather thick, moderately long, and elongately bulbous at the end, of a translucent grey, and finely granulated; the LOWER TENTACLES are only one-fifth the length of the upper pair, and somewhat enlarged basally. MANTLE yellowish-brown or whitish, faintly marbled or spotted with brown.

SHELL subglobose in shape, very thin and translucid, usually slightly glossy, of a pale olive-green or greenish-umber colour, with a thick transversely wrinkled EPIDERMIS somewhat puckered at the sutures with somewhat irregular and more delicate intermediate striæ; the spiral sculpture is microscopic and formed by a close and beautiful series of distinctly incised striations, which gradually become abruptly undulate towards the umbilical region; and the whole surface is also beset with distantly rooted and erect or somewhat bent whitish hairs arranged in a forwardly directed, sinuously oblique series which cross the lines of growth; WHORLS 4–4½ in number, convex and swollen; SPIRE slightly raised, SUTURE deep; MOUTH ample, broadly semi-lunar, expanded and forming nearly four-fifths of a circle; PERISTOME scarcely inflected above, slightly thickened and darkly margined, somewhat dilated basally and partially reflected around the narrow UMBILICUS. Diam., 7 mill.; alt., 4½ mill.

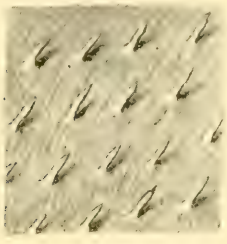


FIG. 46.

FIG. 47.

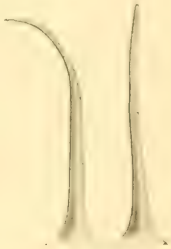


FIG. 48.

FIG. 46.—Periostracum of *Hygromia revelata*, showing arrangement of the hairs on its surface, after a drawing by Mr. G. Sherriff Tye (highly magnified).

FIG. 47.—Periostracal hairs from the shell of *Hygromia revelata*, after a drawing by Mr. G. Sherriff Tye (greatly enlarged).

FIG. 48.—Periostracal hairs from the shell of *Hygromia revelata*, from Guernsey, from a microphotograph by Mr. W. Bagshaw, × 55.

INTERIORLY, specimens from Guernsey showed a cream-coloured RENAL ORGAN and a dusky-brown LIVER or digestive gland, with an indistinct leaden-blue HEPATIC ARTERY.

The ALIMENTARY SYSTEM possesses a very elongate ŒSOPHAGUS and relatively small and compact SALIVARY GLANDS with long slender ducts, showing a notable difference from those of the immature *H. occidentalis* from Tangiers, which display larger and less compact glands and quite short ducts, differences, however, which may be due to age or may be indicative of deeper divergence.

The REPRODUCTIVE ORGANS show a creamy-white OVOTESTIS, a HERMAPHRODITE DUCT convolute and thickened below; ALBUMEN GLAND yellowish-white or ochreous-grey; OVIDUCT white and semi-transparent; SPERM-DUCT or prostate granulate and of a cream-white colour but variable in its width as in *H. granulata*; SPERMATHECA oval or pyriform, white when immature, flesh coloured when adult, the slender stem or duct as long as the oviduct, is thickened below, and originates just above the vaginal mucus glands; VAGINA broad, narrowing below, and in its natural position doubled upon itself; vaginal MUCUS GLANDS are nearly a millimetre in length, one on each side, both deeply divided sometimes quite to the base into two opaque cream-coloured branches; the STYLOPHORES or dart-sacs are quite vestigial, and represented by two mere nipples when immature, but which are distinctly bifid when mature; PENIS-SHEATH very narrow at the base, broadly swollen above; the EPIPHALLUS is somewhat fusiform; the FLAGELLUM short, thick, subulate; the

RETRACTOR MUSCLE is attached to the epiphallus; VAS DEFERENS slender, but thickened at its junction with the penis-sheath. When immature the dart-sacs are

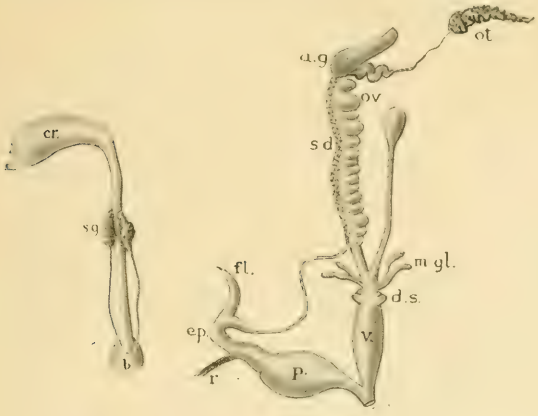


Fig. 49. Fig. 50.

Fig. 51.

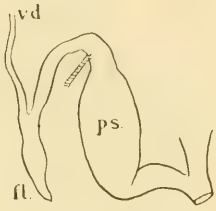


Fig. 52.

Fig. 49.—Proximal part of Alimentary system of *Hygromia revelata*, from Guernsey, collected by Mr. J. R. le B. Tomlin, showing position and character of salivary glands and their ducts.
b. buccal bulb; *cr.* crop; *s.g.* salivary glands.

Fig. 50.—Reproductive system of *Hygromia revelata*, from Guernsey.
a.g. albumen gland; *d.s.* vestigial stylophores and accessory sacs; *fl.* flagellum; *m.gl.* mucus glands; *ot.* ovotestis; *ov.* oviduct; *ep.* epiphallus; *p.* penis-sheath; *r.* penial retractor; *s.d.* sperm duct or prostate; *v.* vagina.

Fig. 51.—Enlargement of distal part of vagina, mucus glands and dart sacs of *Hygromia revelata* from Guernsey, to more clearly show their peculiarities.

Fig. 52.—Penis-sheath and its accessories of *Hygromia revelata*, from Guernsey.
fl. flagellum; *p.s.* penis-sheath; *v.d.* vas deferens.

scarcely perceptible, and the mucus-glands are shorter.

The JAW or mandible is about three-fourths of a millimetre in width; narrow, slightly arcuate, thin, of a fawn or amber colour, except along the cutting edge and the thickened transverse ribs, which are of a blackish brown; there are about twelve fairly distinct transverse or vertical ribs, which extend across the anterior surface, and denticulate the upper and lower margins, and in the specimen examined appear to be arranged in three groups of about four ribs each, the central group forming an obscurely defined median projection.

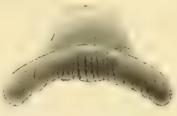


Fig. 53.—Jaw of *H. revelata* from Penzance, ×30, from micro-photo. by Mr. W. Bagshaw.

The RADULA is of the usual type, and about 1½ millimetres long and three-fourths of a millimetre wide, with about 92 sinuately transverse rows of teeth, with a maximum of about 39 teeth in a row, each row being composed of a symmetrical tricuspidate somewhat quadrate median tooth, bearing a stout median cutting point or mesocone and two distinct side cusps or ectocones; this central tooth is flanked on each side by about twelve laterals, which are unequally bifid, the endocone being suppressed; the marginals or outer teeth are the outer series, and are usually about seven in number at each side, they are tridentate in plan, the endocone becoming prominent as an obliquely projecting cutting point; as the margin is more closely approached the ectocone may be duplicate, and the teeth become quadrifid, before reverting to the simple unicuspid type of the outermost row.

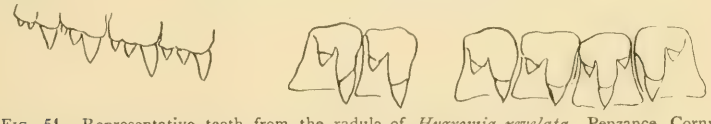


Fig. 54.—Representative teeth from the radula of *Hygromia revelata*, Penzance, Cornwall, from a highly-magnified micro-photograph by Mr. W. Bagshaw.

The formula of a specimen from Guernsey collected by Mr. Tomlin is

$$\frac{7}{3\cdot4}+\frac{1\,2}{2}+\frac{1}{3}+\frac{1\,2}{2}+\frac{7}{3\cdot4}\times 92 = 3{,}588 \text{ teeth.}$$

Reproduction and Development.—Nothing is known of the details of the congress of this species; it is, however, believed to become adult in the autumn, when reproduction takes place, Dr. Brooksbank remarking that in its favourite haunts in West Cornwall the eggs are so abundant in late autumn as to betray the whereabouts of the snail.

Food and Habits.—*H. revelata*, according to the experience of Mr. J. R. le B. Tomlin, is best collected in dry weather, when it may be found at the foot of stones and rocks which are closely edged with short thick grass. After rain it becomes very active, and may be found dotted over the grass and herbage, but is then very difficult to detect.

It is most frequently found near the roots and beneath the foliage of nettles and plants of a tufted and recumbent character, beneath or amongst stones on the tops of cliffs or open downs, but sometimes clustered beneath the shade of the spreading branches of Gorse (*Ulex europæus*).

It is gregarious, and more especially congregates in hollows on slopes where small pieces of disintegrated rock have slipped from above and become piled together.

It shows, according to Mr. Tomlin, a great partiality for a small fragrant wild thyme which abounds on the cliffs. Mr. Rimmer especially remarked that its favourite food was the leaves and roots of the sorrel (*Rumex acetosella*), about whose roots it congregates in its native resorts, and that in captivity it devoured that plant with apparent relish. Mr. Sikes in Scilly always found it at the roots of small dandelions (*Taraxacum officinale*).

In this country it appears to be restricted to the vicinity of the sea, which does not appear to be the case in less vigorous regions, where *H. occidentalis* may be found far from maritime influences in pine woods, at the foot of old oaks, etc., often buried more or less deeply in the earth, but especially on waste land beneath tufts of *Artemisia campestris*.

In winter and during persistent dry weather it is said to bury itself rather deeply in the earth, and in winter forms a protective epiphragm, which is thick, opaque, and white, and sunk somewhat within the aperture; but for summer æstivation this protective device is usually, though not invariably, thin, glistening, and iridescent, with a small opaque spot, or, according to Dr. Jeffreys, a small round hole opposite the respiratory orifice.

At such times it must be looked for by pulling up tufts of grass and turning over large stones which are sunk in the ground, or by searching among the roots of furze bushes or other shrubs.

Geological Distribution.—Recorded by Mr. A. W. Stelfox in a somewhat ancient Holocene deposit at Whitesand Bay, Cornwall.

Variation.—The known variation of this species is very restricted, although several assumed species have been established which differ but slightly from the type.

Profs. Hidalgo and Pilsbry regard as varieties the *Helix coimbricensis* and *H. nevesiana* Silva. Prof. Hidalgo also adds the *H. martigenopsis* of Servain from Lisbon and Mirando de Ebro, *Helix venetorum*, *Helix villula*, and *Helix platylasia* Bourguignat; whilst Prof. Pilsbry adds *H. martigena* Fér.; but some of these, as *H. martigena* Fér., are probably more closely allied to *H. montivaga* or *H. ponentina*.

Distribution of *Hygromia revelata* (Mich.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lanes.
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry

Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

I have, however, carefully collected such information as was available, and whether some of the more distinct forms may eventually be justly separated from *H. revelata* remains to be confirmed by demonstration of structural differences, but the testaceological divergences between the various forms seem to be usually slight.

A variety from Oporto, named by Silva var. *major*, is described as a darker coloured form, with the last whorl somewhat more deflected, and having a diameter of 7½ mill. and an altitude of 4½ mill., but these dimensions do not apparently differ from the size of the type.

VARIATIONS OF SHELL.

Var. **ptilota** Bourguignat.

Helix ptilota Bourg., Mal. Bretagne, 1860, p. 55.

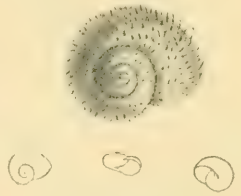


FIG. 55.—*Helix ptilota* Bourg., natural size and enlarged (after Bourguignat).

SHELL described by M. Bourguignat as small, and depressed in shape, equally convex above and below, thin, translucent, and of a pale, dull greenish-brown colour; apex smooth, of a rich black, without striations or hairs, rather strongly striate, and beset with numerous small and rigid white hairs, which are arranged in series in an inverse direction to the lines of growth, which is incorrectly averred not to be the case in *H. occidentalis*, in which also the hairs are stated to be longer and more irregularly distributed. Whorls 4, rapidly increasing in size; suture deep; last whorl more dilated and slightly deflected at the mouth, which is roundly lunate; peristome simple and direct, but slightly reflected round the small and narrow umbilicus.

Diam., 5½ mill.; alt., 4 mill.

France—Rather rare in the hedges bordering the road between Vannes and Auray, about three kilometres from the former place, in the department of Morbihan.

Var. **coimbricensis** Silva.

Helix coimbricensis Silva, Journ. Soc. Math., Phys., e Nat., Lisboa, 1887.

SHELL globosely depressed, with a blunt spire, thin, greenish horn colour, slightly striated, and beset with very short whitish hairs. Whorls 3½, convex, rapidly increasing in size, the last very large and convex, and gradually descending in front. Aperture rounded, somewhat obliquely oblong. Peristome simple. Umbilicus perforate, and more or less covered by the reflection of the pillar lip. Diam., 6 mill.; alt., 4 mill.

Portugal—Coimbra and Bussaco, province of Beira (Westl., Binnenc., 1889, p. 61).

Var. **nevesiana** Silva.

Helix nevesiana Silva, Journ. Soc. Math., Phys., e Nat., Lisboa, 1887, p. 1.

SHELL depressed and umbilicated, opaque yellowish olive, with diffuse wrinkled striation, and irregularly covered with short hairs. Whorls 4, convex, rather quickly but irregularly increasing, the last large, very convex beneath, rapidly descending in front and deflected at the aperture; suture very deep. Aperture obliquely rounded and enlarged, but narrow interiorly. Peristome simple and direct, reflected only above, margins closely convergent. Diam., 6¾ mill.; alt., 4 mill.

Portugal—Sernache das Alhos, Beira (Westl., Binnenc., 1889, p. 62).

Var. **platylasia** Bourguignat.

Helix platylasia (Bourg.) Silva, Journ. Conch. Math., Phys., e Nat., Lisboa, 1887. p. 5.

SHELL very depressed and almost flat, but quite convex beneath, yellowish or greenish horn coloured, beset with small whitish and mostly recumbent hairs. Whorls increasing regularly in size, the last not expanded, but gradually descending and strongly deflected at the aperture, which is oblique and moderately rounded with approximating margins. Umbilicus more open than in var. *villula*.

Portugal and **Algeria**—(Westl., Binnenc., 1889, p. 62).

Var. **occidentalis** Moquin-Tandon.

Helix occidentalis Moq.-Tand., Hist. Moll., 1855, p. 221, and pl. 17, f. 10-13, not of Recluz.

The shell as described by Moquin-Tandon differs little from our British *revelata*, and the divergence shown by the anatomical drawings here reproduced may be due to the less rigorously precise methods formerly in vogue, and cannot be cleared up until the anatomy of the various forms has been carefully studied.

Original Description.—"COQUILLE subglobuleuse, assez convexe en dessus et en dessous, à stries longitudinales demi-effacées, fines, inégales ; mince, fragile, couverte de poils courts un peu roides, peu luisante, transparente, d'un corné fauve légèrement verdâtre. SPIRE composée de 4 à 5 tours assez convexes, croissant rapidement ; le dernier un peu grand, non caréné ; SUTURE profonde. SOMMET obtus. OMBILIC

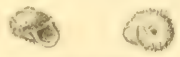


FIG. 56.

FIG. 57.

FIG. 56.—*Helix occidentalis* Moquin-Tandon (after Moquin-Tandon).

FIG. 57.—*Helix occidentalis*, Coimbra, photographed from specimens collected by Prof. Nobre.

petit. OUVERTURE oblique, ronde, un peu échancrée par l'avant-dernier tour. PERISTOME interrompu, subréfléchi, avec un bourrelet interieur plus ou moins épais, blanc, à bords très rapprochés, très convergents ; le columellaire très arqué, réfléchi sur l'ombilic. Hauteur 4-6 mill. ; diam. 5·5—8 mill."—MOQUIN-TANDON, op. cit.

The striæ of the shell are further noted as "obliques et onduleuses, Poils long de 0.75 mill., grêles, pointus, légèrement courbés, un peu transparents, caducs."

The ANIMAL as described by Moquin-Tandon does not differ appreciably from the preceding account of the animal of *Hygromia revelata*.

The animals of the two immature shells sent in Nov. 1887 by Mr. J. H. Ponsonby from Tangiers, had black and dusky bodies, with paler patches and marblings ; the fore-mantle was yellowish-white, with a few scattered black specks, rest of mantle silvery-white also speckled with black ; foot whitish ; kidney whitish ; liver or digestive-gland dark sepia-brown.

The ALIMENTARY CANAL of the immature *Helix occidentalis* from Tangiers differs from that of adult *H. revelata* from Guernsey in the comparatively greater development of the salivary glands and the shortness of their ducts, the Guernsey shells having small, compact, secretory masses and very elongated ducts.

FIG. 58.

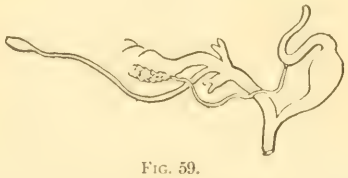


FIG. 59.

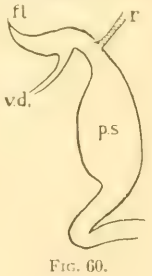


FIG. 60.

FIG. 61.

FIG. 58.—Alimentary Canal of very immature example of *Helix occidentalis*, from Tangiers.

FIG. 59.—Proximal portion of Reproductive system of *H. occidentalis* (after Moquin-Tandon).

FIG. 60.—Penis-sheath and accessories of *H. occidentalis*, from Tangiers (greatly enlarged).
fl. flagellum ; *p.s.* penis-sheath ; *r.* retractor ; *v.d.* vas deferens.

FIG. 61.—Heart and Kidney or Renal organ of *H. occidentalis*, Tangiers (greatly enlarged).

The REPRODUCTIVE SYSTEM of *H. occidentalis* as figured by Moquin-Tandon shows certain differences which if confirmed would probably justify its separation from *H. revelata*. The MUCUS-GLANDS are described as reduced to two nipples cleft at their summits and in comparison with those of *H. revelata* are figured shorter, thicker, and much more fused together, while there are no traces whatever of the dart-sacs, etc., which are so perceptible in our species. The PENIS-SHEATH is quite in harmony with that of *H. revelata*, but the FLAGELLUM which in our species is short, thick, and subulate, is figured by Moquin-Tandon as somewhat regularly cylindrical, and described as short and slightly subulate, continuing the contracted distal end of the penis-sheath by a somewhat shorter appendix.

The penis-sheath and appendages of the immature specimens sent from Tangiers by Mr. Ponsonby are almost identical with those of *H. revelata*.

The MANDIBLE of *H. occidentalis* is figured by Moquin-Tandon and described as three-fourths of a millimetre in width, strongly arcuate, yellowish, extremities slightly dilated and very blunt, with a dozen feebly indicated, flat, and somewhat unequal ribs, which bluntly denticulate the concave margin.

FIG. 62.

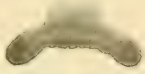


FIG. 63.

FIG. 62.—Jaw of *Helix occidentalis* Moquin-Tandon, highly magnified (after Moquin-Tandon).

FIG. 63.—Jaw of an immature *Helix occidentalis* from Tangiers, from a highly-magnified micro-photograph by Mr. W. Bagshaw.

The mandible from one of the immature Tangiers specimens is comparatively narrow, and shows twenty or more or less indistinctly defined ribs, which are grouped in assemblages of two, three or more ribs, and somewhat irregularly crenulate the cutting margin, but show indications of a blunt median rostrum or beak.

The RADULA of the immature Tangiers specimen shows a smaller and slenderer form of tooth than the British form, and the marginal teeth are less pectinate, a circumstance which, combined with the immaturity of the animal, does not tend to confirm the identity of the two forms. The count of the teeth is also somewhat different, showing 77 rows and 43 teeth in a row in the widest part.

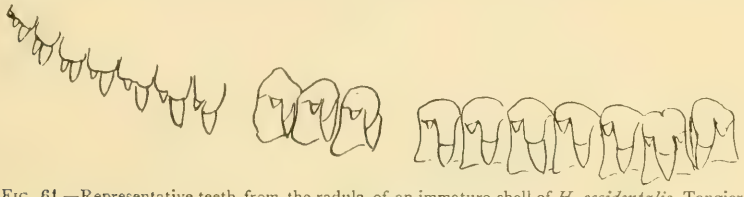


FIG. 64.—Representative teeth from the radula of an immature shell of *H. occidentalis*, Tangiers, after a highly magnified micro-photograph by Mr. W. Bagshaw.

Habits and Habitats.—According to Moquin-Tandon, *H. occidentalis* is a very slow, sluggish, yet very sensitive animal, living mainly at the foot of trees and beneath bushes. Prof. Nobre remarks that it is rather common amongst plants by walls and on sandy soils, but is difficult to find when adhering to old walls; it, however, frequents damp as well as dry ground, as beneath stones on river banks; it is also found by the shore on walls or in rock-crevices, often in company with *Clausiliæ* and *Pupæ* as at Viano, Foz, and Boa Nova near Leça.

Geographical Distribution.—This form, according to M. Bourguignat, is especially abundant in all countries bordering the Atlantic Ocean from Portugal, Spain, and France, to England. He also cites it for the centre of France, around Angers and Paris, and extends its range to Switzerland, Lombardy and the valleys of the Tyrol, as well as noting its reported occurrences in Algeria.

Var. **venetorum** Bourguignat.

Helix venetorum Bourg. ap. Locard, Cat. Gén. Faune Franç., 1882.

SHELL depressed, and covered with very short hairs, which are quickly shed. Whorls flattened, but turgid at the sutures, the last long and descending very low. Aperture oblique, with approximating margins. Umbilicus perforate. Diam., 8 mill. ; alt., 5 mill.

France—(Westerlund, Binnen-Conchylien, 1889, p. 62).

Portugal—Povoa de Varzin, Minho (Westl., Binnenc., 1889, p. 62).

Var. **villula** Bourguignat.

Helix villula Bourg. ap. Locard, Cat. Gén. Faune Franç., 1882.

SHELL depressed and almost flat, densely covered with oblique rows of very long hairs. Whorls convex, very rapidly increasing in size, the last somewhat dilated and gradually descending in front. Aperture relatively very ample. Peristome with margins somewhat convergent and reflected basally around the somewhat open umbilicus. Diameter attaining to 8 mill.

France and **Portugal**—(Westl., Binnenc., 1889, p. 62).

Geographical Distribution.—Under the names of *H. revelata* and *H. occidentalis* this species has been reported from almost the entire extent of the European Atlantic littoral, to which regions it was formerly believed to be restricted, but it has now been reported from other and inland districts, and, according to Mr. Gude, its known range, which was formerly the fifth parallel of east longitude is now extended to the fifteenth degree.

It has, however, been also recorded not only from Central but from Eastern Europe, and if these occurrences prove trustworthy they will strengthen the grounds of belief in the decadent character of the species and in the evidences of its expulsion from the chief evolutionary area.

M. Michaud cites the Alpine valleys as habitats, while M. Bourguignat gives its range as central France, Switzerland, Lombardy, and the Tyrol.

Dr. Kobelt believes it to be a southern and comparatively modern species, as no traces of it have ever been found in pre-glacial deposits.

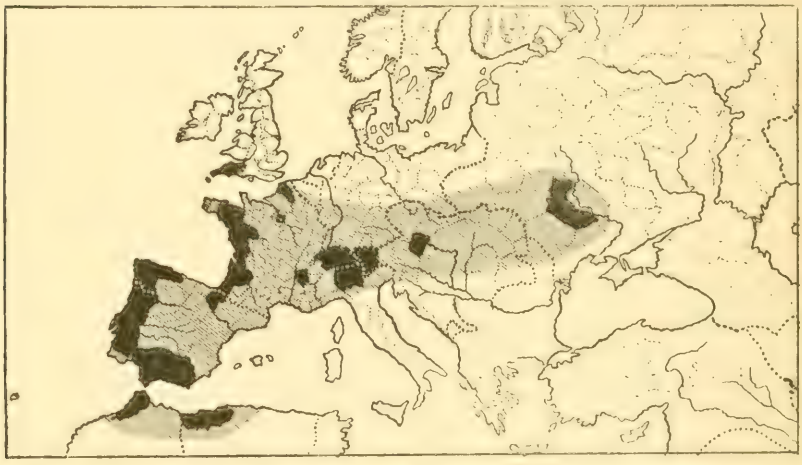


FIG. 65.—Geographical Distribution of *H. revelata* + *H. occidentalis* Moq.

ENGLAND AND WALES.

Channel Isles—In Guernsey it is locally plentiful on the downs of the south coast, and south of Doyle's Monument. Mr. Tomlin records that it extends to the Gouffre, and occurs over the flat ground near Cobo. It was found at St. Peter's Port by Mr. Dodd; and at Moulin Huet by Mr. E. Collier. Numerous specimens collected on the adjacent island of Lihou by Dr. Lukis are in the British Museum.

In Jersey Mr. Benson in 1847 recorded it from the downs on the cliff near Rozel harbour; Mr. Dodd found it on the walls of Port Regent; and Mr. F. H. Sikes at Corbière, Plémont, and La More on the west coast and in July 1905 on Green Island.

In Sark it is locally plentiful on the south downs. Mr. Sikes found specimens in Creux Valley, July 1905; and Mr. Wyndham at Dixcart Bay in June 1904.

In Herm Messrs. Cooke and Gwatkin record it as local but abundant.

In Alderney Mr. Tomlin records it as rather common on the cliffs.

Cornwall W.—The southern coast of this extreme westerly section of England would seem to be the present metropolis of the species in this country. Mr. W. P. Cocks in 1846 found specimens on the Pendennis peninsula and at Falmouth. Mr. J. R. le B. Tomlin reported its presence in Sept. 1884 at the Lands End, at Kynance Cove, and the Lizard. Mr. J. P. Johnson discovered it on rock ledges "high up" on St. Michael's Mount; Rev. Canon Horsley found it at Gwithian, near Portleven, in August 1900. Mr. C. E. Wright collected it in January 1905 from the moss-covered granite walls by Williams' farm, Rosekestal; and Messrs. Wright and

Adams along the wall on the cliff-top between St. Leven and Porthcurno. Mr. A. P. Gardiner reports its occurrence at Sennen. Mr. H. C. Huggins discovered it at Porthcurnow; and Dr. Brooksbank found it plentifully at Marazion, Rosemullion, Goldswithney, Mousehole, and Nanjizal Bay in Oct. and Nov. 1910.

Scilly Islands—Mr. F. H. Sikes records it from Tresco, Tean, and St. Mary's.

Cornwall E.—The known localities in this district are not numerous, though the species was first discovered in the British Isles with its limits. Mr. J. C. Bellamy in Oct. 1839 having found specimens near Mevagissey, though examples had previously been collected by a Mr. Colley, who, however, regarded them as *H. fusca*. It has also been collected by Mr. John H. Adams at Lemain near Looe; reported by Mr. C. Ashford as common in Sept. 1870 beneath furze-bushes on Rame Head near Plymouth and has been found in Whitesand Bay by several observers.

On the north coast it was first found in 1887 by the Rev. A. H. Cooke and the late Mr. S. J. da Costa, at Newquay, on the downs above the cliffs near the sea; and Mr. Howard Fox has found a single shell at St. Columb Minor.

Devon S.—Mr. G. C. Bignell found this species commonly in places about Stonehouse and Plymouth in and before 1876. Mr. G. D. H. Carpenter discovered it on Bolt Tail Cliffs near Kingsbridge; Mr. Fenn at Torcross; Mr. George Sich at Brixham; and Mr. Hanley at Torquay. Specimens are in the Exeter Museum collected at Dawlish by the late Mr. E. Parfitt, who also found it at Axminster.

Devon N.—Discovered on Lundy Island by Mr. J. R. le B. Tomlin, who found it abundantly on the grassy slopes of the granite cliffs in April 1906.

Somerset N.—One specimen reported as found Aug. 1883 on the cliffs near Lady Bay, Clevedon, by Miss Jessie Hele.

Notts.—Mr. E. J. Lowe recorded finding three specimens of this species in Sept. 1851 among moss and fallen leaves under an oak tree at Stanton-on-the-Wolds.

SCOTLAND.

Fife—Capt. Brown recorded that in 1827 he described as *Vitrina membranacea* specimens of this species from the Lomond Hills, but these are evidently *H. fusca*.

FRANCE.

Apparently chiefly in the western region, and has been recorded from

Basses Pyrénées—Reported from St. Jean-de-Luz by Mr. G. K. Gude.

Charente Inférieure—M. Granger quotes it as most common in the littoral region. Comm. Caziot gives St. Nazaire.

Côtes-du-Nord—Reported from Dinan by Mr. G. K. Gude.

Deux Sèvres—Recorded by Drouet from Niort.

Gironde—Dr. Gassies says it is dispersed over the department, but scarcely common, and mentions Arcachon, La Teste, La Hume, Facture, Mios, Salles, Audenge, Arès, Lége, Piquey, etc., as localities. Dr. Scharff also discovered it at Branne on the River Dordogne.

Indre-et-Loire—Recorded for the department by Michaud and others.

Ille-et-Vilaine—As *H. occidentalis* M. Bourguignat reports it from the sandhills of Cancale, and as well distributed in Brittany.

Isère—Rare in the Alpine Valleys (Gras, Moll. Isère, 1840, p. 32).

Landes—As *H. occidentalis* recorded by Moquin-Tandon from Mont-de-Marsan.

Loire Inférieure—M. Dautzenberg quotes *H. revelata* as present in the Cailliaud Collection in Nantes Museum under the name of *H. ponentina*; the localities named by Cailliaud under that name are Nantes, Croisic, Pornic, Nozay, Derval, etc. As *H. occidentalis* M. Bourguignat reports it as common on the coast at St.-Nazaire.

Lot-et-Garonne—Moquin-Tandon records it as *H. occidentalis* from St. Julien-de-Fargues; and M. Fagot records *H. revelata* from Nerac.

Maine-et-Loire—Reported on the authority of Baron Férussac from Angers by M. Michaud, who later recorded it from Baupréau; Abbe Ravain from the Forest of Combrée; Abbe Bardin from Sainte-Gemmes-sur-Loire; and M. Servain from Petit-Puy near Saumur.

Morbihan—M. Taslé reports its presence at Vannes, Quiberon, Roche-Bernard, Ploermel, and Belle-île; and M. Bourguignat records *H. ptilota* from near Vannes.

Pas-de-Calais—Recorded for the department by Comm. Caziot.

Seine—Reported by M. Michaud from Paris on the authority of Baron Férussac.

Vendée—Cited by M. Letourneaux in 1869 from Fontenay-le-Comte.

ITALY.

Lombardy—M. Bourguignat gives Lombardy as a locality for *H. occidentalis*.

SPAIN.

Andalusia—M. Pallary alludes to the specimens from the south of Spain as being a trifle larger than Moroccan shells.

Asturias—Recorded by Dr. P. Fischer from Asturias and reported from Picos de Europa by Prof. Hidalgo.

Galicia—Recorded by Mr. McAndrew and confirmed by Prof. Hidalgo from Vigo; and by Zapater and Macho as rare about Villagarcia and Santiago.

Navarre—Recorded as *H. occidentalis* by Martorelli and Paz.

PORTUGAL.

Beira—Prof. Nobre records *Helix occidentalis* from Aveiro, Azurara, Buarcos, Bussaco, Cabo Mondego, Coimbra, Condeixa, Figueira, Fonte da Vinha, Granja, Serra do Pilar, Soure, Valongo, and Vila Nova de Gaia, also from Pinheiro da Bemposta on the authority of Ribeiro.

Alemtejo—It is quoted for Estremóz by Prof. Hidalgo; and as *H. occidentalis* from Evora and Castelo de Vide by Prof. Nobre.

Estremadura—Prof. Nobre records *H. occidentalis* from Algés, Bemfica, Caldas da Reinha, Cintra, Colores, Leiria, Lisbon, Marvila, Serra da Arrábida, Setubal, and Soure. Dr. G. Servain cites the alluvium of the Tagus; Furtado gives Sabugo; de Sousa records Alfeite, and specimens from Serra de Monsanto and Calhariz are in the Museum Bocage; and Mr. Ponsonby found it in open fields about Lisbon.

Minho—Recorded by Prof. Hidalgo from Leça da Palmeira; as *H. occidentalis* from mossy garden walls in a shady lane on the banks of the R. Douro near Oporto by Mr. J. H. Ponsonby, and by Prof. Nobre from Valença, and Viana do Castelo.

Tras os Montes—Recorded as *H. occidentalis* by Prof. Nobre from Macedo de Cavaleiros, Mirandela.

SWITZERLAND.

M. Bourguignat cites this country as an undoubted location for *H. occidentalis.*

AUSTRO-HUNGARY.

Tyrol—Dr. Jeffreys, on the authority of Strobel, quotes the Lower Tyrol as a locality, and Paetel cites the Tyrol.

Lower Austria—Dr. von Martens quotes Parreyss' record of Klosternenberg.

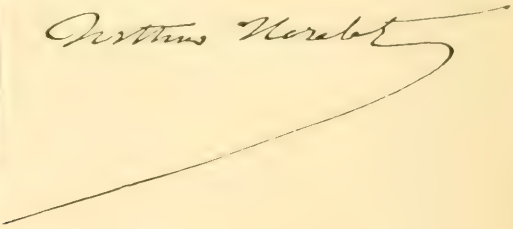
RUSSIA.

Kiev—Dr. Westerlund records that specimens exist in St. Petersburg Museum, collected at Kiev in 1849.

NORTH AFRICA.

Morocco—Djebel Kébir, near Tangiers, found by M. Vaucher. Mr. J. H. Ponsonby has also collected *H. occidentalis* only under stones on the open scrubby downs near Tangiers.

Algeria—Recorded as *H. occidentalis* by M. Debeaux from beneath stones in the forest of Boghar, and along the roads to Milianah; and M. Lallemant found a single specimen among *Cistus* on the dry slopes at Agha near Algiers.

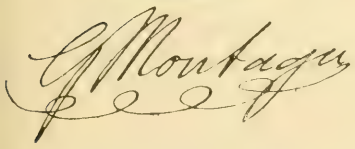


Portrait and Autograph of M. Arthur Morelet, the author of "Mollusques Terrestres et Fluviatiles de Portugal," wherein is described and figured *Helix ponentina*, which hitherto has been regarded as a synonym or variety of *H. revelata.*

Sub-Genus *Zenobia* Gray.

Hygromia fusca (Montagu).

1803 *Helix* **fusca** Montagu, Test. Brit., ii., p. 424, pl. 13, f. 1.
1821 — (*Zenobia*) *corrugata* Gray, Med. Repos., vol. xv., p. 229.
1823 — *subrufescens* Miller, Ann. of Philos., vii., p. 379.
1838 — *revelata* Bouchard-Chantereaux, Moll. Pas de Calais, p. 44.
1850 — (**Hygromia**) *fusca* Pfeiffer, Verz., p. 127.
1855 — (*Zenobia*) *fusca* Moquin-Tandon, Hist. Moll., ii., p. 212, pl. xv., ff. 33–36.
1906 — (*Capillifera*) *fusca* Honigmann, Beitr. zur Moll., p. 190.
1906 — (*Trichia*) *fusca* Westerlund, Catal. reg. Palæarct., p. 27.
1843 *Zonites fuscus* Macgill, Moll. Aberdeen, p. 93.
1855 — (*Conulus*) *fusca* Adams, Gen. Moll., p. 116.



HISTORY.—*Hygromia fusca* (*fusca*, brown) was added to science and to the British list in 1803 by the famous British zoologist, Colonel George Montagu, with whom the species is herewith associated, and it is with especial pleasure that I am able to give the accompanying authentic portrait and autograph, for which privilege I am indebted to the sympathetic interest of Dr. B. Daydon Jackson, the courteous and learned secretary of the Linnean Society.

This species would seem to be little known on the continent, possibly on account of its being overlooked and neglected as the young stage of some of the larger *Helices*.

The sub-genus *Zenobia* is a group instituted by Dr. J. E. Gray in 1821 for *H. fusca* and other species, but has been widened and altered by later authors to include other species in its scope.

It has been defined as shell conoid, with a perforate umbilicus, and a thin and simple apertural margin, to which should be added to ensure more stability to the group, the more striking features of the internal organs, as the presence of a four-bladed dart—recalling that of *Helix pomatia*—a single dart sac with a small accessory gland, and well-developed mucus glands.

Dr. Grateloup described a shell as *H. aquitanica* which he was inclined, and probably correctly, to regard as a variety of *H. fusca*.

It was characterized by its greenish-amber colour, and was thin, translucent, and glossy; whorls were five in number; mouth semilunar; lip simple, sharp, and fragile. Diam., 8 mill.; alt., 5 mill.

Abundant in autumn in gardens and woods, Mont-de-Marsan and Agen.

Diagnosis.—*H. fusca* differs from *H. revelata* with which it is most likely to be confounded by its larger size, more depressed spire, and the absence of the greenish shade which is so marked a feature in that species.

INTERNALLY, it is easily separated by the presence of a well developed dart-sac and accessory gland, by the characteristic love-dart, by the peculiar and almost filiform spermatheca, and the long and delicate flagellum.

Description—ANIMAL elongate and varying in colour between a vinous-yellow and blackish or greenish-grey, but darkest anteriorly, and there is no trace of facial grooves; the BODY is more or less tuberculate; the DORSAL FURROWS are fairly distinct; OMMATOPHORES long and slender; LOWER TENTACLES blunt and short; there are dark subdorsal lines, one on each side the body, which run to near the tips of the tentacles, and are due to the TENTACULAR RETRACTORS being perceptible through the semi-transparent tissues; the MANTLE is marbled or speckled with white and brown.

When crawling, the PULMONARY RETICULUM is clearly visible through the pellucid shell and tissues, and extends backwards about half-a-whorl from the APERTURE up to the long and narrow yellowish RENAL ORGAN; the HEART, which is closely adjacent, clearly displays its responsive pulsations. Beyond the renal organ, the MANTLE is black, finely speckled with yellowish or greyish, the spots increasing in number until the general effect towards the apex of the shell becomes reversed, and shows as yellowish-grey with black spots. The margin of the aperture usually shows a black patch extending along and near to the suture.

SHELL subglobose, subconical above, convex beneath; WHORLS $4\frac{1}{2}$ to 5 gradually enlarging in size, the last whorl ample and subangulate at the periphery, suture distinct but not deep; shell substance very thin, fragile, and of a deep transparent amber colour, but exceedingly glossy; transverse STRIÆ irregularly plicate or corrugate with intermediate finer growth lines; spiral striæ ill-defined and slight, but most perceptible in the umbilical region; APERTURE obliquely and broadly lunate, outer lip sharp and thin, abruptly inflected above and much reflected basally, partially concealing the very minute umbilical perforation. Diam., 9 mill.; alt., $5\frac{1}{2}$ mill. EPIPHRAGM extremely thin and vitreous.

Dr. J. E. Gray describes the hairy investment as so fine and deciduous that the surface is frequently supposed to be without hair. Reeve describes the shell as "minutely hairy," and the late Mr. G. Sherriff Tye has stated that the hairs are thickly clustered on the surface of the shell, are very short and bent towards the aperture, but are only perceptible under a high magnifying power.

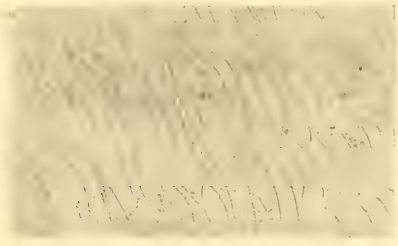


FIG. 68.

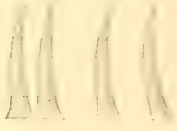


FIG. 69.

FIG. 68.—Hair-like sculpture of the shell surface of *Hygromia fusca*, after a micro-photograph by Mr. W. Bagshaw.

FIG. 69.—Hairs from surface of the shell of *Hygromia fusca* (highly magnified), after a drawing by the late Mr. G. Sherriff Tye.

A careful examination of the shell surface with a 1-inch objective shows that the appearance of crowded hairs referred to by Mr. Tye is possibly due to the minute sculpture which, however, lies parallel to and not at right-angles with the growth lines as described by him, and are probably the fine striæ referred to by Dr. Gwyn Jeffreys as found on immature shells and which he compared to "hair-cloth."

INTERIORLY, the ŒSOPHAGUS and STOMACH are greyish-white; the LIVER or digestive gland dark brown, sometimes flecked with whitish, the hepatic artery not conspicuous, and the intestinal fold whitish; the KIDNEY or renal organ is almost sagittiform in shape, of a salmon colour, speckled with yellowish-white, and the HEART has the junction of the auricle and ventricle almost filiform.

The REPRODUCTIVE ORGANS show a large and white OVOTESTIS, which has its upper side partly imbedded in the brown or russet liver; the HERMAPHRODITE DUCT is dusky-white or cream colour spotted with brown; the ALBUMEN GLAND is of a very pale greenish-yellow; the OVIDUCT ochreous-grey; the PROSTATE or sperm-duct whitish-buff of a granular aspect, and externally wider than the oviduct in parts; SPERMATHECA narrow, digitate, or lanceolate, of a whitish colour dashed with bluish, and borne on a long and slender stem; PENIS-SHEATH short and

obovate, abruptly flexed and bluish-white in colour, with longitudinal white streaks at the narrowing distal end; EPIPHALLUS long, of an uniform thickness and furnished with a retractor about midway of its course; the FLAGELLUM is long and filiform.

FIG. 70. FIG. 71. FIG. 72. FIG. 73.

FIG. 70.—Dart-sac of *Hygromia fusca* (showing position of the dart within the sac), accessory sac and digitate mucus glands, greatly enlarged.

FIG. 71.—Reproductive organs of *Hygromia fusca*, greatly enlarged.

d.s. dart-sac and accessory gland; *fl.* flagellum; *m.gl.* mucus-glands; *ov.* oviduct; *p.s.* penis-sheath; *r.* penial retractor; *sp.* spermatheca; *sp.d.* sperm duct.

FIG. 72.—Gypsobelum or Love-dart of *Hygromia fusca*, with mid-section of stem, × 12.

FIG. 73.—Ovotestis imbedded in the digestive gland of an immature *H. fusca*, greatly enlarged.

The vaginal MUCUS GLANDS are three or four mill. in length, and bluish-white in colour, subulately vermiform and irregularly tumid; they are usually seven to nine in number, though somewhat variable in this respect, as by bifurcation there may be as many as twelve or even more terminations.

DART-SAC pearly-white, elongately ovate, and fairly bulky, combined with a smaller accessory glandular sac or lobe, which rises a little higher, and fused to the vagina on almost the total length of the gland; the outer sac contains and secretes the dart.

The DART occupies the large outer sac or lobe, is of a subulate shape, about two mill. long, very sharply pointed, the shaft gracefully bent, with four equidistant longitudinal blunt-edged blades, which arise from the expanded base, and gradually diminish towards the apex, quite reminiscent of that of *Helix pomatia*; the swollen base occupies about one-fourth of the total length of the dart and expands somewhat abruptly from the gently tapering shaft; there is no annulus, but there are usually one or more horizontal encircling grooves.

The JAW is about three-quarters of a millimetre from side to side, of a fawn or deep amber colour, darker in the central area and towards the cutting-edge, of a crescentic shape, with bluntly rounded ends, with twenty to twenty-eight not very prominent ribs which crenulate the cutting margin.

Moquin-Tandon describes the jaw as possessing fifteen fine closely-set indentations on the concave cutting margin, and figures it as very broad, with a very wide and obtuse but quite perceptible median rostrum or beak.

FIG. 74.—Jaw of *H. fusca*, (Montagu) highly magnified, from Scarbro', Yorks.

The RADULA is of the usual oblong shape, and composed of 95 transverse rows of teeth, with a maximum of about 53 teeth in a row, each row formed by a median

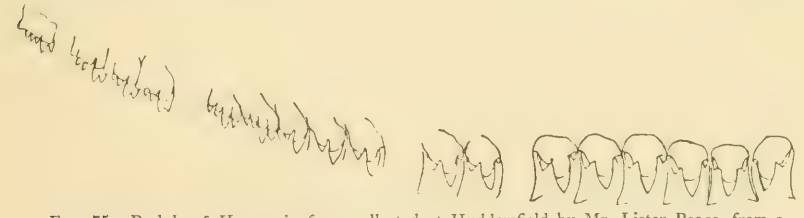


FIG. 75.—Radula of *Hygromia fusca* collected at Huddersfield by Mr. Lister Peace, from a highly magnified micro-photograph by Mr. W. Bagshaw of a preparation by Rev. Prof. Gwatkin.

tricuspidate tooth, with a strong central cone, and quite small ectocones; the laterals are about 14 in number, and also tricuspidate, the ectocones being well developed, but the endocones are very feebly represented and gradually diminish in size; the marginals are more or less quadrate in shape, and characterized more especially by the splitting of the mesocones, by a very decided overlapping of their lateral margins and in a lesser degree by the division of the smaller ectocones.

The formula of a Huddersfield specimen collected by Mr. Lister Peace and the radula prepared by Rev. Prof Gwatkin is

$$\frac{1\,2}{3\cdot5}+\frac{1\,4}{3}+\frac{1}{3}+\frac{1\,4}{3}+\frac{1\,2}{3\cdot5}\times 95 = 5{,}035 \text{ teeth.}$$

Reproduction and Development.—No observation appears to have been made of the sexual congress of this species, except by Capt. Farrer, who, on Nov. 11th, 1905, observed individuals in conjugation at Bassenthwaite; but the function probably takes place from August till towards the end of the year. The eggs are laid shortly after the congress, and are from 30–50 in number, 1 to 1½ mill. in diameter, and globular in form, with a thin, transparent, and opalescent envelope; they hatch in about twenty days, the young becoming adult during the following season.

Habits and Habitat.—*Hygromia fusca* is found fairly commonly in districts where it occurs, living upon the sedges bordering the streams in moist or damp woods, and is a habitual climber, especially in the early autumn months, ascending the alder, beech, poplar, hazel, osier, juniper, mountain-ash, and other trees, feeding upon the leaves and clinging to their undersides. It also frequents many plants, especially the great hairy woodrush (*Luzula sylvatica*), the meadow sweet (*Spiræa ulmaria*), campion (*Lychnis dioica*), dog mercury (*Mercurialis perennis*), *Iris*, *Equisetum*, nettles, sedges, ferns, brambles, etc., and is easily collected by shaking shrubs or the lower branches of trees over an umbrella.

In France, at Mont-de-Marsan, it abounds on the bindweed in the hedges, as well as on the osiers and the marsh-reed.

It is a very hardy species, and in late autumn and winter is remarkably active and more geophilous in habit, living amongst the decayed leaves and herbage.

Though evidently feeding on a great variety of plants, Capt. Farrer finds that in the Lake district its favourite food is wild carrot (*Daucus carota*).

M. St. Simon has recorded that he had observed 85 pulsations per minute of the heart of this species, but gives no details of the conditions under which the observation took place.

Mr. Masefield has noticed its marvellous protective resemblance to the decaying seed capsule of the campion (*Lychnis dioica*), the thin shell being the exact colour of the capsule when wet, and the base being of a pale yellow colour exactly resembles a portion of the viscera of the snail as seen through the shell.

Parasites and Enemies.—In addition to the usual Helicidian enemies, Mr. Evans has observed that the bank vole (*Evotomys glareolus*) seems particularly fond of this species, as he has found an abundance of broken shells at the entrance of their burrows.

Geological Distribution.—Recorded by Dr. Jeffreys as fossil in our Upper Tertiary formation; by Prof. Morris as found in the Mammaliferous Crag, at Stutton, Suffolk; and by M. Laville, in France, from the gravels of Joinville-le-Pont, department of the Seine.

Variation.—Only two forms of *H. fusca* have as yet been distinguished, as it is not a species which lends itself to a splitting-up into many forms.

Abbé Dupuy has observed that this species is more especially maritime in habit, and remarked that the finest specimens are always found in the vicinity of the coast, the shells gradually becoming smaller and rarer in proportion as the inhabited district is removed from maritime influence.

The var. *alba* alluded to in the Journal of Conchology, vol. ix., p. 110, as found at Worth Wood, Ramsor, Staffs., would appear to be an error, but it may be remarked that Colonel Montagu alludes to a "beautifully white and pellucid shell," sent to him from Scotland by Mr. H. Boys, "in every respect like *H. fusca* except in colour," though Dr. Jeffreys, who made a special examination of the type shells in Montagu's collection now preserved in the Exeter Museum, states that the Scotch specimen above mentioned is really referable to the species now known as *H. cartusiana*.

Var. **vitrea** Farrer, Journ. of Conch., viii., p. 157, Jan. 1896.

SHELL pale glassy-green, animal pure white except the tentacular retractors.

Only as yet recorded from few localities.

ENGLAND.

York N.E.—Forge Valley, Scarborough (J. A. Hargreaves, J. of C., xii., p. 302).

Northumb. S.—Cockshot Hill, Stocksfield-on-Tyne, Aug. 1883 ! H. Richardson.

Cumberland—Not uncommon with the type form, Park Woods, Bassenthwaite (Farrer, l.c.).

IRELAND.

Wicklow—Abundant with type, Powerscourt demesne, Enniskerry, Aug. 1904, P. H. Grierson.

Kerry—Abundant with type on "flags" near Aghadoe, Sept. 1898 (Stubbs and Adams, Irish Nat., 1898, p. 262).

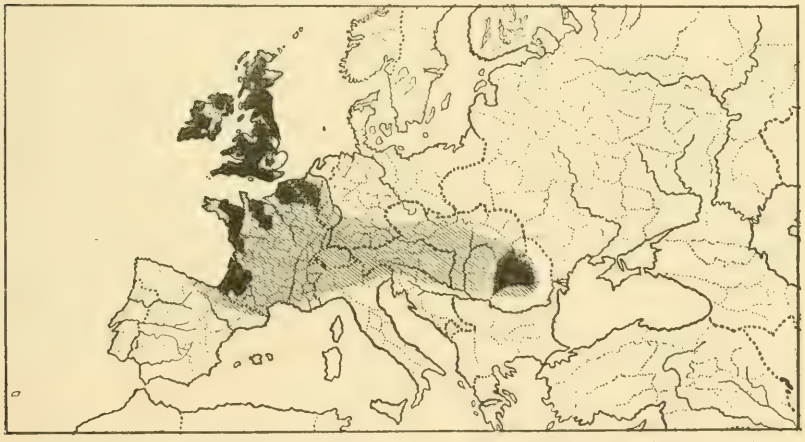


FIG. 76.—Geographical Distribution of *Hygromia fusca* (Montagu).

Probable Range Recorded Distribution

Geographical Distribution.—*Hygromia fusca*, as far as at present recorded, is quite occidental in its range, and is scarcely known from Eastern Europe or elsewhere, probably passed over as the immature state of some of the larger species, so that this apparently limited distribution may be due in some measure to oversight and misapprehension.

This is a striking example of a recessive or retreating species, the recorded and also the verified occurrences showing its apparent absence from the south-eastern counties of England, and its increasing abundance as it recedes from the probable point of entry of superior life. In the north of Scotland it is the most generally distributed of the *Hygromiæ*.

In the British Isles, its distribution is distinctly western and northern, being commonly found over the greater parts of Scotland, Ireland, and Wales, extending as far north as Sutherlandshire.

In England, it appears to be quite absent from East Anglia, and rare for some distance adjacent to that area.

On the Continent, it is only recorded for Belgium, the North and West of France, Spain and Portugal, although Dr. Jeffreys recorded it from Transylvania, but not as a result of his own observations, but on the authority of Bielz.

NETHERLANDS.

Belgium—Tabulated for Belgium by Dr. Hermann Jordan.

FRANCE.

In this country *H. fusca* has a southern range, and seems in a large measure submaritime in its resorts. It is known from

Basses Pyrénées—Found at Salies-de-Bearn in 1903 by Mr. Hugh Watson.

Calvados—Said by M. de l'Hôpital to be somewhat rare about Caen, Colombières, Fouguerolles, forêt de Cerisy, etc.

Côtes-du-Nord—Recorded for the department by Mabille.

Eure—Found in a beech wood at Evreux in April 1912 by Mr. F. H. Sikes.

Gers—Abbé Dupuy and others cite the environs of Auch.

Gironde—Reported by M. Fagot.

Ille-et-Vilaine—Recorded by M. Desmars.

Landes—Recorded by Abbé Dupuy from Dax and Mont-de-Marsan.

Loire Inférieure—M. Calliaud reports it as common in the copses near Nantes; in Brillant Wood on the road to Paris; and at Sautron; and Dr. Jeffreys found it at Etretat in the autumn of 1856.

Lot-et-Garonne—Reported by M. Fagot from Nérac.

Nord—Recorded for the department by M. Norguet.

Orne—Quoted by M. Letacq from the marsh at Radon, etc., in the forest of Ecouvres, the marshes of Fontenay-les-Souvets, and the forests of St. Ortave and Ferté-Macé, etc.

Pas-de-Calais—Common about Boulogne-sur-Mer, according to M. Bouchard-Chantereaux, who recorded it as *H. revelata*.

Sarthe—Cited by Letacq for the wood of Noë-de-Gesne, Arconnay; the wood at Champ-Charlot, near Bourg-le-Roi, etc. Langlois cites the wood of Perrochell, etc.

Somme—Recorded by M. Norguet as living on *Populus canadensis* at Abbeville.

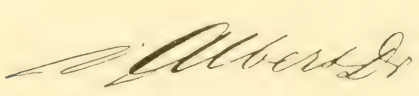
Vendée—M. Letourneaux reports it as rare at Vouvant, Fontenay-le-Comte.

SPAIN AND PORTUGAL.

M. Fagot reports it as Pyrenean and also as a species of the Spanish littoral, which is also found in Portugal, but this is not confirmed by any other writer.

AUSTRO-HUNGARY.

Recorded by Bielz from Transylvania.



Autograph of Dr. Joh. Christ. Albers, the distinguished German conchologist, and author of "Die Heliceen" and other meritorious works on land and freshwater mollusca.

Helicodonta obvoluta (Müller).

1767 *La Veloutée à bouche triangulare* Geoffroy, Coquilles de Paris, p. 46, no. 12.

1774 *Helix* **obvoluta** Müller, Verm. Hist., pt. 2, p. 27, no. 229.
1788 — *holosericea* Gmelin, Syst. Nat., i., p. 3641, no. 186.
1792 — *trigonophora* Lamarck, Journ. d'Hist. Nat., ii., pl. 42, f. 2, p. 349.
1792 — *bilabiata* Olivi, Zool. Adriatic, p. 177.
1801 *Planorbis obvolutus* Poiret, Coq. de l'Aisne, p. 89.
1819 **Helicodonta** *obvolutum* Férussac, Tabl. Syst., p. 38, pl. 51, f. 4, no. 107.
1833 *Trigonostoma obvoluta* Fitzinger, Syst. Verz. Oesterr., p. 98.
1837 *Vortex obvoluta* Beck, Ind. Moll., p. 29.
1837 *Gonostoma obvoluta* Held, Isis, p. 915.
1842 *Polygyra obvoluta* Gray, Fig. Moll. Anim., pl. 290, f. 13.
1844 *Euphemia obvoluta* Menke, Zeitschr. f. Malak., v., p. 74.
1853 *Anchistoma obvolutum* Adams, Genera Recent Moll., p. 207.

H. L. Boycott.

HISTORY.—*Helicodonta obvoluta* (*obvoluta*, rolled up), belongs to the subgenus *Helicodonta* of Férussac, which is wholly or partially equivalent to *Chilodon* and *Helicodon* Ehrenb., *Drepanostoma* Porro, *Contorta* Muhlf., *Caracollina* Beck, and other groups cited in the synonymy.

With this interesting species I feel great pleasure in associating my esteemed and valued friend, Prof. A. E. Boycott, F.R.S., who has given special attention to this species and authoritatively elucidated many doubtful and important points of its structure, and to whom many of the special illustrations and much of their descriptive matter is due.

Helicodonta, which Dr. Scharff regards as originating in the Lusitanian region, is a group of Mediterranean species in which the shell is characterized by an angulate or rhombic aperture and a depressed spire, and an animal allied in organization to *Helicigona* and apparently linking together that group and *Hygromia*; its relationship with the higher groups is shown by the position of the right tentacular retractor which passes between the ♂ and ♀ organs, as in the true or typical *Helices*, and its affinity with *Helicigona* is evidenced by the paired mucus glands and lanceolate love-dart, which, although wholly or partially lost by degeneration in the present species, are still possessed by some of the less dominant Helicodonts, which are now chiefly restricted to the lofty mountain ranges of Central Europe.

This very remarkable phenomenon of the total atrophy of the dart and the partial loss of its accessories by the present species though still retained by *H. holoserica*, its less dominant and probably more ancient congener, lead us to place less implicit faith in the presence of any particular organ or in any specific detail of the internal bodily structure—save of the sensory or nervous system—as irrefragable evidence of

superiority in dominating power of any species and show that the facts of geographical distribution as proof of dominance must always receive the consideration due to their undeniable importance.

Dr. Germain regards as the ancestral form the *H. bernardi* Michaud, a much smaller shell, of about 5 mill. in diameter, with a more vertical aperture, which replaces *H. obvoluta* in the diluvial clays of Combe-de-Clary, near Hauterive, Drôme.

It was first discovered in this country in Ditcham Wood, Hampshire, and added to the British list in 1831, by Dr. Lindsay, in a communication to the Linnean Society.

Diagnosis.—*H. obvoluta* cannot be confused with any other British species, the depressed and somewhat concave spire, and the more or less distinct indications of the apertural denticles preclude possibility of error.

INTERNALLY, the differences from other British species are equally striking, the degree of degeneracy exhibited by the organs assumed to represent the mucus-glands and dart-sac being amply sufficient to satisfactorily determine the species.

Description—The ANIMAL is slender, of a dark leaden-grey colour, with large and moderately distinct rugæ, which do not present any readily perceptible arrangement; DORSAL GROOVES distinct, and enclosing a single row of ELONGATE TUBERCLES; there is no trace of facial furrows, and a mere indication of LATERAL GROOVES shown by the paler colouring of the area beneath their position, the tubercles of this paler portion appear of a darker grey against the pale ground colour; the TAIL is narrow and pointed, and does not extend beyond the margin of the shell; MANTLE pale greyish, speckled with a darker shade; OMMATOPHORES long and slender, semitransparent, and showing the dark RETRACTORS throughout their length, and giving a darker shade to each side of the back; the MUCUS is colourless and thin, but not very plentiful. The shell is carried almost horizontally, and slightly inclined to the right.

SHELL discoidal in shape, flat or slightly concave above, convex beneath; WHORLS 6½, increasing slowly in size and deflected at the aperture when adult, laterally compressed, but bluntly angulate above, near the suture, which is thus deeply channeled; EPIDERMIS thick, opaque warm-brown in colour, bearing obliquely undulate striæ and beset by a number of smooth, stiff, caducous and slender whitish hairs, furnished with several knobbed excrescences along their length, sometimes bent at the tip, or even almost prone and usually inclined to be recurved or directed in the opposite direction to those of *H. hispida*; they are arranged in oblique rows, which run in an almost opposite direction to the lines of growth, and are borne upon indistinct protuberances, which are said to be arranged somewhat quincunxially, but do not all support hairs. APERTURE small and obliquely triangular, inflected above; OUTER LIP very thick, reflected, and obscurely toothed within on the basal and palatal margins, of a purplish colour, which, however, is very fugitive and quickly fades on the death of the animal; there is also a distinct constriction or groove behind the lip, especially deeply sunk behind the palatal tooth-like thickening. The UMBILICUS is openly convoluted, almost tubular, and exposing all the internal spire.

FIG. 79—*Helicodonta obvoluta* (Müll.) after Sandberger.

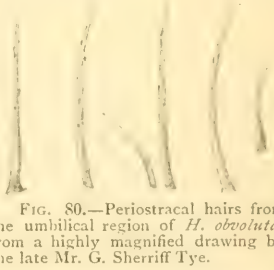


FIG. 80.—Periostracal hairs from the umbilical region of *H. obvoluta*, from a highly magnified drawing by the late Mr. G. Sherriff Tye.

Diam., 12 mill.; alt. 5 mill.

The REPRODUCTIVE ORGANS are, according to Moquin-Tandon, thick and white and aggregated in a trilobed form; the HERMAPHRODITE DUCT is thick and somewhat convolute, but attenuate at each extremity; the ALBUMEN GLAND is small, thin, of a yellowish colour, irregularly lobulated and curiously bent over at the tip;

the VESICULA SEMINALIS is rather large, the bulb white, and the stalk red with pigment evidently resident in the epithelium; and André says the pedicle shows a longitudinal furrow similar to that shown in a grain of wheat, and the free extremity there is a slightly trilobed glandular body, connected by an excessively thin pedicle from one of the lateral lobes. The FREE OVIDUCT is curiously slender and long, and bears high up the small oval SPERMATHECA on a long and slender

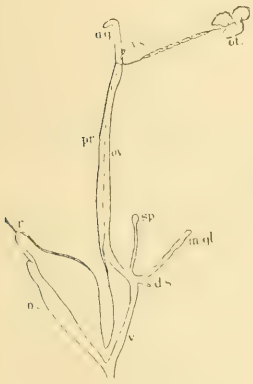


FIG. 81.

FIG. 82.

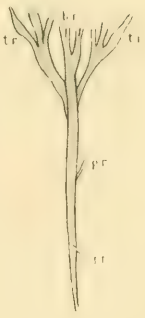


FIG. 83.

FIG. 84.

FIG. 81.—Reproductive system of *Helicodonta obvoluta* (after a greatly enlarged dissection and sketch by Prof. Boycott).
a.g. albumen gland; *d.s.* vestigial dart-sac; *m.gl.* vestigial mucus-gland; *ot.* ovotestis; *ov.* oviduct; *pr.* prostate; *p.s.* penis-sheath; *r.* penial retractor; *sp.* spermatheca; *v.* vagina or free-oviduct; *v.s.* vesicula seminalis.

FIG. 82.—Proximal portion of sexual system of *Helicodonta obvoluta* (after Moquin-Tandon), showing the approximate natural positions of the various parts.

FIG. 83.—Cephalic retractors (after a greatly enlarged dissection and sketch by Prof. Boycott).
b.r. buccal retractor; *p.r.* penial retractor; *r.r.* rectal retractor; *t.r.* retractor of ommatophores, the adjoining muscles arising from the same stem serve the lower tentacle and lip of their respective sides.

FIG. 84.—Alimentary system of *Helicodonta obvoluta* (after a greatly enlarged dissection and sketch by Prof. Boycott).
b.b. buccal bulb; *c.* crop; *r.* rectum; *s.gl.* salivary glands; *st.* stomach.

stem; immediately beneath it is an elongate thin walled blind vermiform sac, slightly swollen at end, destitute of muscle-fibres, and fairly full of amorphous white flocculent particles, but there are no large calcareous cells, such as are often found in the genital passages; this is probably a MUCUS-GLAND.

FIG. 85.

FIG. 86.

FIG. 87.

FIG. 85.—Section through assumed vestigial mucus-gland of *Helicodonta obvoluta*, highly magnified (after a drawing by Prof. Boycott).

FIG. 86.—Section through the assumed vestigial dart-sac of *Helicodonta obvoluta*, highly magnified (after a drawing by Prof. Boycott).

FIG. 87.—Vesicula seminalis of *Helicodonta obvoluta* with adjacent parts (after a greatly enlarged dissection and sketch by Prof. Boycott).
a.g. albumen gland; *h.d.* hermaphrodite duct; *ov.sp.* ovispermatoduct; *v.s.* vesicula seminalis.

Another, but much shorter cœcum, quite different in structure, is attached to and opens into the mucus-gland before merging into the free oviduct, which is probably a vestigial DART-SAC, which has, however, now lost all traces of the crystalline love-dart it formerly possessed, but still retains the thicker walls and a fairly

abundant muscular coat, but no calcareous cells were detected ; the VAS DEFERENS is slender and generally shows an abrupt and very persistent sigmoid flexure, which is basally attached to the columellar muscle, before entering the penis-sheath ; the RETRACTOR is attached to the vas deferens, which thickens before joining to the penis-sheath, and though showing differences of size, etc., there are no apparent differences of structure, and therefore probably there is no epiphallus ; the PENIS-SHEATH is singularly voluminous, thick, but attenuate above, the vas deferens entering terminally.

In the natural position when the animal is extended, the free oviduct from its commencement to the opening of the dart sac is bent in a sigmoid flexure, the spermatheca duct arising from its highest point ; the spermatheca, as is usual, lies against the oviduct, and the mucus gland is twisted round the S bend.

The ALIMENTARY SYSTEM shows an excessively long ŒSOPHAGUS, with thick and bulky whitish salivary glands; the œsophagus gradually merges into the CROP, which is apparently merely an expansion of it, and combined with the STOMACH, whose pyloric end is abruptly bent ; the GUT is of the usual triodromous character, the middle tract being somewhat capacious, and the rectal tract long and slender.

The CEPHALIC RETRACTORS show an elongate central stem, attenuate at its insertion on the columella of the shell, and near the base giving off a muscular strand to the rectum, as well as the penial retractor, which arises from a point about one-third of the length from the distal end, agreeing in this arrangement with the primitive Australian genus *Panda*. The two tentacular muscles are given off almost subterminally, they are powerful muscular bands, and each divides to serve the ommatophore, tentacle, and lip of their respective sides ; the BUCCAL RETRACTOR is formed by the continuation of the main muscle, and just before reaching the buccal bulb it divides, each branch again bifurcating before attachment thereto.

The MANDIBLE or jaw is about one mill. from end to end, flatly crescentic in shape, and bluntly rounded extremities, of an amber colour, of rather delicate consistency, with thickened and darker areas most distinct medially and towards the ends, and showing one central and several longitudinally parallel paler lines ; there are a somewhat variable number of broad, flat, rather indistinct vertical ribs, which slightly crenulate the lower or cutting margin, but do not extend quite across the jaw.

FIG. 88.—Jaw of *H. obvoluta* (Müll.) (highly magnified) after a micro-photograph by Mr. W. Bagshaw.

The RADULA is of the usual oblong shape, and consists of from about 145 to 170 transverse rows of teeth, each row consisting of 71 to 91 teeth, and constituted by a median unicuspid tooth, about 13 or 14 unicuspid laterals, and about 28 bicuspid and tricuspid marginals, which at the extreme margins degenerate into simple chitinous bars.

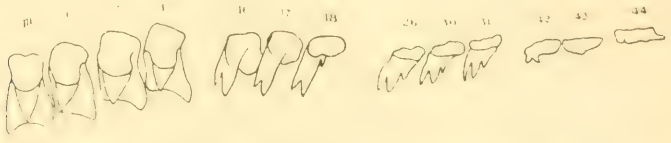


FIG. 89.—Representative teeth from the radula of *H. obvoluta* (Müll.), from Ditcham Wood, Hampshire, after a highly magnified drawing by Prof. Boycott.

The formula of a Ditcham specimen, according to Prof. Boycott, is

$$\frac{2\,5}{3} + \frac{4 \text{ to } 5}{2} + \frac{13 \text{ or } 14}{1} + \frac{1}{1} + \frac{13 \text{ or } 14}{1} + \frac{4 \text{ or } 5}{2} + \frac{2\,5}{3} \times 160 = 14{,}240 \text{ teeth.}$$

Reproduction and Development. — Few observations have been made upon the sexual congress of this species, but Mr. L. Dawes, who has carefully studied this species in confinement, found a pair in the act of conjugation in the early morning of June 27th, 1912; the animals were facing each other, but not in actual contact, except by their intromittent organs, which were united together over the heads of the snails ; he also verified that oviposition takes place from May to the end of June, the eggs being white and laid in clusters varying in numbers from 8–20, and

Distribution of *Hygromia fusca* (Montagu)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lancs
70 Cumberland
71 Isle of Man

SCOTLAND.

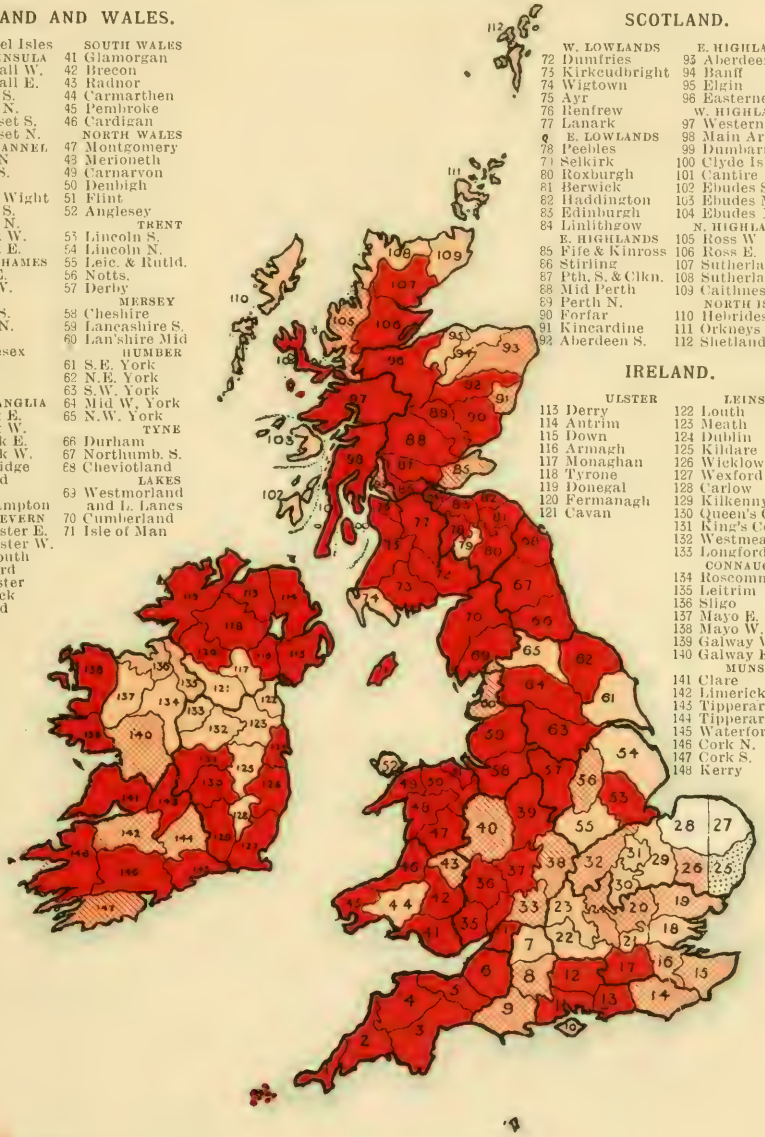
W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E
108 Sutherland W.
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford
CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

slightly adherent to each other, though separable by the slightest touch; that they hatch in about a month; and that all the young hatched in captivity after June died, while those hatched earlier in the year and kept under identical conditions survived, full growth being attained in October and November of the following year.

Mr. H. Beeston, from a long acquaintance with the species in its native habitat, thinks that oviposition is continued all through the summer months, as he finds shells in all stages of growth quite late in the autumn and even in their winter quarters when they had only attained about one-third of their normal size, and believes that the eggs are deposited singly or at most two or three together, so that the young unlike those of many other species are not naturally gregarious; Mr. A. W. Stelfox, however, has recorded the finding on May 17th, 1908, of a nest of about a dozen newly-hatched young under a fallen log in the woods on Duncton Beacon.

Mr. Beeston also states that the individuals hatched in spring became adult in October or November, those hatching later attaining full growth in spring after hibernation.

Dr. Gassies records that in France accouplement takes place from May to July, and that the oviposition of about a score very small eggs follows a few days after mating. The eggs are agglutinated together by a colourless mucus; the young emerge in about twenty days; they are when young intensely hirsute with stiff velvety pile, and become adult at the end of November.

Food.—In captivity Miss Hele found the favourite food to be dock (*Rumex obtusifolius*), but they also fed upon plaintain (*Plantago major*), dandelion (*Leontodon taraxacum*), and cabbage (*Brassica oleracea*).

Mr. L. Dawes, who has had considerable experience in rearing this species, found the animals to eat lettuce (*Lactuca sativa*) greedily, but they also freely feed upon fungi, preferring a thick leathery fungus growing on old logs (*Lenzites betulina*), and especially a small, soft and watery cup-shaped kind; they also devour very rotten beech wood, or the minute growths thereon.

The late Mr. W. Jeffery kept this species in confinement, supplying them with decayed wood, leaves, and damp moss, on which they appeared to thrive; he was of opinion that when at liberty the food was principally lichens from the stems of trees, and rotten wood.

Mr. Beeston, who has studied this species for twenty years, is strongly of opinion that naturally it does not usually feed on the living leaves of trees or plants, but regards minute lichens, mycetozoa, and fungi as their staple food, to which in dry, hot summer days he adds the damp and dead decaying beech leaves. He also has often observed them collected together devouring the plasmodium of certain species of the Mycetozoa found upon decaying timber lying in contact with fallen leaves or the bare ground, and he especially remarks on their preference for putrifying and deliquescent fungi, particularly *Boletus edulis*; in such situations specimens may always be found if inhabiting the vicinity. The mycelium of fungi is probably also fed upon.

Habits.—*H. obvoluta* is said to be rather active, and secretes a good deal of clear slime, and is not easy to find, except when out feeding after rain, or in the evening. In showery weather it may ascend high up the beech trees. In dry weather it retires into the hollows of old decaying

beech stumps, and other hiding places, protected from the wet. Rev. W. A. Shaw says it only seems to come out on very wet days, when it crawls under logs, etc.; at other times it is concealed amongst the "caked beech leaves or amongst stones." Mr. L. Dawes has observed that in captivity they seem to avoid the light, and after feeding conceal themselves beneath the leaves, and do not emerge from their shelter even at night during strong northerly winds. They are quite timid, and retreat instantly within the shell when touched. Locard says they live in small colonies and are rather common in shady places at different altitudes, but generally at more than 1,000 feet elevation, though it is recorded as having been found at an altitude exceeding 5,000 feet in the Tyrol.

Dr. Lindsay, in recording its occurrence in this country, affirmed its presence only on the north slope of the South Downs, a belief which has in a great measure persisted to the present time; but Mr. Beeston declares that individuals are actually more plentiful and finer on the southern slope.

This species is characteristic of the mountain regions of Central Europe, extending to the Pyrenees, and according to Calcara is found in Sicily; and though in this country practically confined to the calcareous hills of the South Downs is, in other countries, not restricted to any particular geological formation, or to any special environment.

The species still lurks in the recesses of the primeval woodland tracts on the slopes of the downs and in ancient parks, often associated with *Clausilia rolphii* and *C. laminata* var. *albina*, and dead shells are found in spots where repeated search has failed to yield the living animal. Mr. Clement Reid remarks that it is really abundant in all suitable localities in Sussex as far east as the river Arun, usually occurring on a dry calcareous shady soil with a steep slope, and that its rarity is due to the scarcity of ancient woodlands, as it is quite absent from the extensive beech-woods planted a century ago.

H. obvoluta is essentially a geophilous and somewhat gregarious species, seldom climbing trees except during showery weather, which is the only time when it comes out freely in the daytime from its retreats amidst the aggregated beech leaves and other places, and crawls freely about. In dry weather it hides within the hollows and crevices of decaying stumps, and usually in places sheltered from excessive wet.

The method of locomotion is often very peculiar; the whole length of the foot not being applied closely to the surface traversed, but touching in three or four places only, the points of contact changing. In this mode of progress the animal raises the fore-part of its body and applies the most anterior part to the surface, forming an arch, which gradually passes by undulatory motion down the body, by the gradual affixing of the fore-part of the foot and a corresponding raising of the hind-part of the arch; the arch thus travels from the head to the tail, the tail being then lifted up and put down as the arch travels down to it.

Hibernation and Æstivation.—It is commonly reported to hibernate for a long period, commencing as early as September, but this may be based upon a misconception, as each time the mollusk withdraws within its shell, after feeding, etc., it always secretes the cretaceous epiphragm, which hermetically seals up the mouth, and this everyday occurrence has been adduced as proof of the mollusk being actually in winter quarters.

Mr. Beeston remarks that it is apparently a hardy species, and can withstand a certain amount of cold. The adults tend to be gregarious, and gather together in close proximity in autumn and winter, before retiring to their winter quarters in November or December, according to the rigour of the season, though reappearing in any milder intervals that may occur, the favourite place being heaps of dead leaves and especially the underground crevices amongst the dead and decaying roots of the moss-covered stumps of beech trees, burrowing in such places often to a considerable depth, and not secreting the usual epiphragm, which is always present when hibernation takes place amongst the leaves above the ground. On finally reappearing in the moist days of early spring, the snails climb a few feet up the beech trunks, probably to feed upon the small, soft, succulent lichens which grow in that position.

The EPIPHRAGM is thick, white, and calcareous, slightly sunk within the aperture, and therefore reproducing the somewhat trifoliate shape of the aperture, as well as showing one or even two externally concentric lines of growth or secretion. *H. obvoluta*, unlike the generality of *Helices*, does not appress and attach the aperture of the shell to the surface upon which it is resting by means of the epiphragm, but very frequently, before sealing up the aperture, secretes in addition to the epiphragm, a filament of mucus rich in lime which emanates from the basal margin of the aperture and is affixed to the surface upon which the creature is resting; this filament varies in size, and may be 5 mill. in length; the attachment to the object rested upon is almost linearly arcuate in shape; it has also a broad basis of attachment to the lower lip, and is quite capable of sustaining the animal and its shell. This habit, which resembles that of certain *Clausiliæ* and several operculate species, is interesting, and would also serve to explain the "ball" of *H. obvoluta* said to have been once found hibernating socially and "stuck together" in a cluster. It is recorded as hibernating at the base of hazel trees, and in hedge banks, amongst dead leaves, and in other convenient places. It is not a close hibernant, but reappears and feeds in any milder intervals.

Geological Distribution.—The former wider range of *H. obvoluta* in this country is attested by its occurrence in the fossil state in the Pleistocene gravels of the Cam, in which neighbourhood it is quite unknown in the living state.

Though the genus existed in the Miocene age, the earliest record of the present species is from the Pliocene deposits of Italy, but it has not yet been detected below those of Pleistocene age in other countries.

In Quaternary deposits it is known from many places in Central Europe, North Italy, Switzerland, South Germany, the Danubian Valley, etc.

UPPER PLIOCENE.—In Italy, it is recorded by Prof. Sandberger from Castellarquato near Piacenza, Tuscany.

PLEISTOCENE.—In England, Mrs. McKenny Hughes records the finding of one adult and one immature shell in the gravels of Granchester near Cambridge, the specimens being deposited in the Woodwardian Museum.

In Germany, Dr. Bœttger records it as present in the old alluvium of Frankfort, Nassau; Dr. Hocken from diluvial sands and calcareous tufa near Bruhoden, Gotha; Dr. von Ihering from diluvial tufa at Ober-Zaunsbach and Streitberg, Franconia; and by Herr Clessin from the tufa of Regensburg.

In France, Comm. Caziot records its presence in the Alpes Maritimes, in the clays of Villefranche-sur-Mer; in the tufa of Montigny near Vernon; and in the recent stalagmitic deposit near Vence; Maury and Caziot found it in the tufa of Mantega and Magnan; and Mr. G. Neville from the zone of *Helix paretiana* in the

deposits of Roquebrune, and from the bone breccia of Menton. M. Laville records it from the gravels of Joinville-le-Pont, Seine. H. Cardot from the Ardennes at Montcy-Notre-Dame; from the section exposed in the railway cutting at Hirson near Wasigny Station, and in a calcareous tufa deposit on the outskirts of the wood of Neudan. Dr. Germain records it from the tufa of Baume d'Hostun, and Buisse, Isère; of Presle, Aisne; and of St. Pierre-les-Elbœuf, Seine Inférieure; from the loess about Lyons, St. Fons, and Irigny, as well as from the marls of Gerland, Rhône.

In Belgium, it is recorded by Locard from the Upper Pleistocene of Hainault.

In Switzerland, it is reported by Dr. Sterki from Caverne near Thagugen, Canton Schaffhausen.

In Italy, it is present in the glacial clays of Piedmont, according to Pollonera; in the "terra rossa" of Monte Pisano, according to Locard; Dr. Pantanelli records it from the post-Pliocene travertin of Siena, Tuscany; and Signor Valentini from the similar deposit at Ascoli-Piceno, Marches.

Lower Pleistocene.—In Germany, Prof. Sandberger has recorded it as small and very rare in the sands of Mosbach, Baden.

Mid. Pleistocene.—In Germany, Sandberger quotes it from calcareous tufa at Cannstadt, Wurtemburg, Burgtonna, and Weimar, Thuringia.

In France, Locard records it from the tufa of Celle-sous-Moret, Seine-et-Marne.

Upper Pleistocene.—In Germany, Sandberger states its occurrence in the tufa at Weimar, Burgtonna, and Muhlhausen, Thuringia, and Canth in Silesia.

Holocene.—In England, Rev. W. A. Shaw found specimens thrown up by the moles from a Holocene deposit two to three feet below the surface on the open treeless down, the nearest trees being the ancient Yews at Kingley Vale near Chichester.

In Germany, Prof. Cockerell reports specimens in the museum of Basel from glacial diluvium of Roman age at Kilfis, Lower Alsace.

In Belgium, Gregoire cites it from the "tourbe" of Uccle-lez-Bruxelles, Brabant.

In France, M. Dollfus records it as common in a deposit of Roman age exposed during an excavation at Lyons-la-Forêt, Eure. The species does not now inhabit the neighbourhood.

In Sweden, Dr. Westerlund records it from a submarine peat-bed at Ystad, Malmohus; and Odhner from calcareous tufa at Skultorp, Westergötland.

In Denmark, Dr. Johannsen records it from the freshwater limestone at Free Harbour, Copenhagen; Steenberg from deposits at Korsör, Zealand; and Nordmann from those at Stovaflejringer near Oxnebjerg, Isle of Funen.

Variation.—In the gloomy mountain forests of Switzerland it has been observed by Dr. Hartmann that the shell becomes paler, thinner, and more transparent.

The *H. obvoluta* var. *bosniaca* Bœttger and *H. obvoluta* var. *edentula* Westl. seem equally referable to the typical form as understood on the continent and as figured herein after Prof. Sandberger.

The British specimens incline more or less distinctly to the toothed form, var. *dentata*, but this peculiarity is not often strongly developed.

Var. **albina** Taylor, var. nov.

Shell white.

CONTINENTAL DISTRIBUTION.

Germany—Recorded as numerous at Polesina, Franconia, by Clessin, who also records colonies all albine found on heaps of loose stones in the 'Muschelkalk' region near Ochsenfurt, Bavaria; and Gysser records it from Carlsruhe, Baden.

Belgium—One specimen found in June 1872 at Hastière, Namur, by M. van den Broeck apparently links the present form with the var. *pallida*, the shell being quite transparent, the peristome of brilliant porcelain-white, and the hairs quite colourless. The mollusk was not albine, but very pale.

France—Recorded from Alsace by Prof. von Martens on the authority of Dr. Muhlenbeck.

Var. **pallida** Moquin-Tandon, Hist. Moll. France, 1855, ii., p. 114.

SHELL thinner, more transparent, and of yellowish-rufous colour, with a more velvety surface.

The shells from Provence described by Dupuy as thinner, nearly pellucid, and of a velvety aspect, owing to the more numerous and more recumbent hairs, would appear to belong to this variety, and are probably the form he discriminated as var. *pyrenaica*.

CONTINENTAL DISTRIBUTION.

France—Rather common in Haute Loire according to Pascal; Locard cites it as rare about Lyons, Rhône, and as rather rare at Haut-Bugey, Hauteville, Ain.

Var. **dentata** Clessin, Exc. Moll. Fauna, 1884, p. 133.

Helix blanci Pollonera, Atti Soc. Italiana Sc. Nat., 1884.
Helix spinelliana Pollonera, Agg. Mal. terr. del. Piemonte, 1886.

The apertural projections more distinct and prominent.

The sub-var. **blanci**, of which *H. spinelliana* is a synonym, "differs from typical *obvoluta* in the more distinctly trilobed aperture, which is more outwardly prolonged at its lower external angle, by the basal margin being more strongly calcified interiorly and nearly concave exteriorly, and also by the deeper external depressions at the termination of the last whorl corresponding to the two apertural teeth." The most striking peculiarity is perhaps the somewhat rectangular callosity or denticle on the convex inner basal margin.

FIG. 90.

FIG. 91.

FIG. 90.—*H. obvoluta* sub-var. *blanci* Pollonera, from Bassano, Venetia, slightly reduced.
FIG. 91.—*H. obvoluta* var. *dentata* Held, from Weimar (after Sandberger).

ENGLAND.

Hants. S.—Var. *dentata*, Ditcham Wood near Petersfield (C. S. Coles).

CONTINENTAL DISTRIBUTION.

Germany—Recorded from Nassau and Pappenheim, Wurzburg, and Eichstadt, Bavaria, by Kobelt and Sandberger; by Bœttger from Clauswald and the ruins of Bodenlaube, Kissingen, Franconia; and by Sandberger from the Suabian Alps.

Sandberger records and figures it from Weimar in calcareous tufa of Upper Pleistocene age.

Italy—Prof. Pollonera reports sub-var. *blanci*, Piedmont; Bassano and Schio, Venetia; and Arona, Lombardy.

Austro-Hungary—Luttach, Tyrol (in Coll. Sikes, Brit. Mus.). The sub-var. *blanci*, Carniola (Prof. Pollonera).

Var. **major** Locard, Moll. Ain, 1881, p. 35.

SHELL larger.

The var. **major** s.s. is described as "shell of large size and of a paler colour."

ENGLAND.

Hants. S.—Mr. H. Beeston has found a specimen in Ditcham Wood, 14 mill. in diameter.

CONTINENTAL DISTRIBUTION.

France—Locard records this variety as rather common at Miribel, Ain; and Wattebled from Bois de Ternant and Bois St. Jean-de-Bœuf, Côte d'Or.

M. Charpentier has observed that the shells from Provence attain a larger size than those living in the north.

Switzerland—Specimens 13 mill. in diameter from Balstal, Canton Basel, are recorded by Bollinger.

Var. **parvula** Hartmann, Gaster. Schweiz., 1840, p. 16.

Helix obvoluta var. *minor* Locard, Moll. Ain, 1881, p. 35.

SHELL smaller; 8 mill. in diameter and 4 mill. in altitude.

The sub-var. **minor** Locard is described as "shell small, less than 10 mill. diam., of a darker colour, with close and rather long hairs." The sub-var. *minor* of Caziot as 10 mill. in diameter and $4\frac{3}{4}$ mill. in altitude.

Dr. Hartmann states that in Sturm's Fauna he named the dwarf form *Helix parvula*, but apparently did not describe it.

CONTINENTAL DISTRIBUTION.

Germany—Dr. Hartmann records his var. *parvula* from Neuwied, Rhenish Prussia; and Dr. Sandberger records "small" specimens as very rare in the Lower Pleistocene sands of Mosbach, Baden.

Belgium—Extremely small shells recorded by Rofliæn from Dinant, Namur.

France—Recorded by Locard from the mountains of Parves near Belley, Ain; by Wattebled from Bois de Ternant and Bois St. Jean-de-Boeuf, Côte d'Or; and by Comm. Caziot from the Alpes Maritimes at the Col des Quatre Chemins near Nice, from beneath pine trees at Cannes, and on the road to Pegomas.

Switzerland—Dr. Hartmann has found his var. *parvula* at St. Gallen and St. Gallencappel; Bollinger recorded specimens 9 mill. in diameter from Allschwiler Wald, Canton Basel; Prof. Studer discovered it near Berne, and Comm. Caziot records specimens from the same place 9 mill. in diameter and $4\frac{3}{4}$ mill. in altitude.

Monstr. **sinistrorsum** Adams, Manual of British Shells, 1896, p. 59.

SHELL reversed.

The only known shell, which is now in the collection of Mr. J. R. le B. Tomlin, was purchased many years ago by Mr. W. H. Heathcote, of Preston, at a sale of shells at Messrs. Stevens' Auction Rooms, London. The shell is not quite mature, has about $5\frac{1}{4}$ whorls, and has not formed the adult aperture.

It is stated to have been found in Ditcham Wood, Hampshire.

Monstr. **scalare** Grateloup, Cat., p. 54, 1855.

Whorls more or less dislocated.

CONTINENTAL DISTRIBUTION.

France—Recorded from North France by Dr. Grateloup.

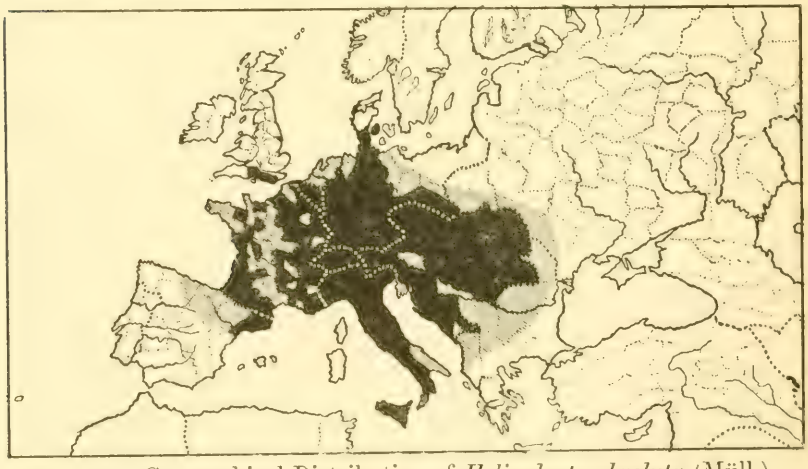


FIG. 92.—Geographical Distribution of *Helicodonta obvoluta* (Müll.).

Probable Range Recorded Distribution

Geographical Distribution. — Dispersed throughout Middle and Southern Europe, in moist and cool places, and usually though not invariably in mountain regions, but is most plentiful in the south, but according to Comm. Caziot never found in the immediate vicinity of the sea.

In England it occurs only on the South Downs of Sussex and Hampshire, and is apparently curiously restricted to an area about forty miles in length and six miles in width. It has also been recorded from Kent, but this record appears to have been due to error or oversight.

Hants. S.—First recorded as a British species in 1831 by Dr. James Lindsay who during May 1830 found specimens in Ditcham Wood near Buriton, where it is still fairly common. Dr. Gwyn Jeffreys has, however, placed on record that he had previously received a specimen from Mr. G. B. Sowerby, collected at the same place. Miscombe Hangar near Harting, C. E. Wright. Crabbe Wood, Winchester, Sept. 1885 ! Thomas Rogers.

Hants. N.—Alresford, in woods (Bellars, Brit. Shells, 1858, p. 12). Ashford wood, and Steep near Petersfield, March 1886, Chas. Ashford. Rather common at Stonor Hill (Jeffreys, Brit. Conch., 1862, p. 230). Liss, Feb. 1899, C. Stanley B. Cox.

Sussex W.—William Wood, Up Park, Rev. W. A. Shaw. Up Park, the wooded margins of Charlton Forest, Graffham and Singleton, 1886, W. Jeffery. Copse, quarter of a mile north of Pen Hill, Elsted, Clement Reid. Common at Rook Clift, Treyford, and thereabouts, chiefly in beech woods, and especially near water, Clement Reid and G. Gordon. Didling Hangar; wood below the east end of Bepton Down ; Bignor Hill ; Glatting Hangar ; Farm Wood, Sutton ; Graffham and East Lavington on scarp at parish boundary ; on scarp at Woolavington Down ; Barlavington Hangar ; the hazel-copse, Winden Wood near West Dean, and Fryar Hangar, Duncton, Clement Reid. The wooded slopes of Duncton Beacon, Apr. 1908 ; and on a damp overgrown road-side bank at Bignor near Amberley, remote from the natural scrub of the downs, May 1908, A. W. Stelfox. Lavington near Petworth, June 1893, A. G. Stubbs. Hangar south-east of Heyshott Farm, Aug. 1906, E. W. Swanton. Phyllis Wood near Buriton, Mr. Houseman.

On the southern escarpment of the South Downs, Mr. W. Jeffrey recorded it from Woodend and Kingley Vale near Chichester, but the Rev. W. A. Shaw believes that only dead shells were found, and that they were probably fossil and washed from the Post Pliocene deposits of the neighbourhood in which *H. obvoluta* is found.

On the east side of the Arun, Mr. W. Borrer is recorded as having found it at Spring Head near Storrington.

Surrey—Several dead shells were found from time to time by the late Mr. S. J. da Costa in widely separated spots in the beech woods of Norbury Park near Box Hill, and as the Dorking line of Downs is quite distinct from the Buriton-Duncton range, its occurrence there in a living state would be interesting. The Druids' Grove, Dorking, where other dead specimens were found by Mr. Kenneth McKean, is really a part of Norbury Park, but consists mostly of yew trees.

GERMANY.

Distributed mainly in the west and south of the empire, and specially noted as existing in Alsace, Baden, Bavaria, Bremen, Coburg, Darmstadt, Franconia, Gotha, Hanover, Holstein, Hesse-Cassel, Lauenberg, Lippe, Lorraine, Magdeburg, Merseburg, Nassau, Pyrmont, Reuss, Rhenish Prussia, Saxony, Schleswig, Silesia, Suabia, Thuringia, Weimar, Westphalia, and Wurtemburg.

NETHERLANDS.

Belgium—Probably found throughout the country, and has been reported from Brabant, Hainault, Liege, Limburg, Namur, Luxemburg, and Grand Duchy of Luxemburg.

FRANCE.

Especially common in the north, central, and eastern regions, and reported from the following provinces and departments :—Ain, Aisne, Agenais, Alpes Maritimes, Allier, Ardennes, Ariège, Aube, Aude, Basses Alpes, Basses Pyrénées, Calvados, Charente Inférieure, Côte d'Or, Drôme, Champagne Méridionale, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Haute Savoie, Hautes Pyrénées, Ille-et-Vilaine, Isère, Jura, Landes, Lot, Lot-et-Garonne, Lozère, Meuse, Maine-et-Loire, Moselle, Nièvre, Nord, Oise, Provence, Pyrénées Orientales, Puy-de-Dôme, Rhône, Saone-et-Loire, Sarthe, Savoy, Seine, Seine-et-Marne, Seine-et-Oise, Seine Inférieure, Somme, Var, Vaucluse, Vendée, Vienne, Vosges and Yonne.

ITALY.

Distributed throughout the peninsula, but chiefly restricted to the southern slope of the Alps, and to the upper zone of the Appenines ; and found in Abruzzi, Calabria, Campania, Emilia, Liguria, Lombardy, Marches, Piedmont, Romana, Tuscany, Umbria, Venetia, and the Island of Sicily.

IBERIAN PENINSULA.

Spain—Recorded by Fagot, Graells, and also by Zulueta from Catalonia.

Portugal—Comm. Caziot records it as indicated for Portugal in Musée Martorell, but remarks that the record may be erroneous; it is, however, also given as Portuguese by Locard, Sandberger, and others.

AUSTRO-HUNGARY.

Ranging through the empire and existing in Upper and Lower Austria, Bohemia, Bosnia, Carinthia, Carniola, Croatia, Dalmatia, Galicia, Goritz, Hungary, Moravia, Transylvania, Tyrol, and Vorarlberg.

SWITZERLAND.

Probably ranging over the whole country, but actually known from Aargau, Appenzell, Basel, Berne, Geneva, Grisons, Lucerne, Neûchatel, Schaffhausen, St. Gall, Schwyz, Solothurn, Ticino, Unterwalden, Uri, Valais, Vaud, and Zurich.

DENMARK.

Reported by Dr. Westerlund from the Island of Aerö.

Beech Hangar, in Ditcham Wood, near Ditcham House, on the south slope of South Downs, Hants., a rich locality for *H. obvoluta*. The photo. shows Mr. H. Beeston, who has so thoroughly studied this species, holding a dead fallen beech branch on which are several *H. obvoluta*.

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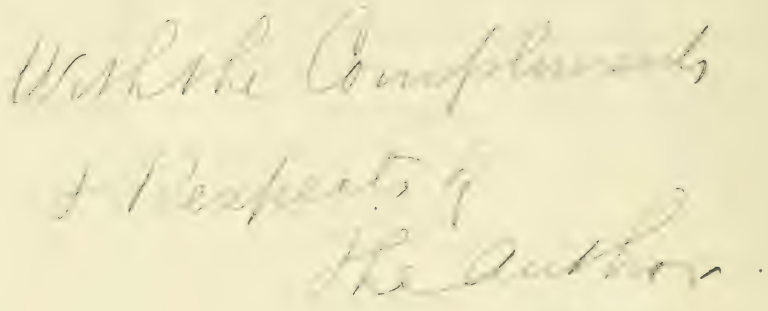

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HYGROMIA, THEBA, AND ASHFORDIA.

Hygromia umbrosa (Partsch) × $\frac{1}{3}$.
Margate, East Kent, J. C. Dacie.

Theba cartusiana (Müller) × $\frac{1}{4}$.
Needham Market, Suffolk, A. Mayfield.

Theba cartusiana var. *fasciata* × $\frac{1}{4}$.
Syracuse, Marquis Monterosato.

Theba cartusiana var. *almonis*.
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Theba cantiana var. *albocincta*.
Osgodby, Yorks., W. Nelson.

Theba cantiana var. *da campi* × $\frac{1}{4}$.
Verona, E. von Martens.

Theba cantiana var. *rubella* × $\frac{1}{4}$.
Watford, Herts., J. Hopkinson.

T. cantiana var. *brunnea* v.nov. × $\frac{1}{4}$.
Goole, W. West.

T. cantiana var. *charpentieri* × $\frac{1}{4}$.
Sandown, Isle of Wight, J. W. Wood.

A. granulata var. *cornea* × $\frac{1}{2}$.
Laugharne, C. Jeffreys.

Ashfordia granulata (Alder) × $\frac{1}{2}$.
Ashley Down, Bristol, Miss F. M. Hele.

SUB-GENUS *Trichia* Hartmann.

Hygromia umbrosa (Partsch).

1828 *Helix* **umbrosa** C. Pfeiffer, Naturg. Deutsch. Moll., iii., p. 27, pl. vi., f. 7.
1869 — (*Zenobia*) *umbrosa* Slavik, Moll. Böhmen, p. 98, pl. i., ff. 29, 30.
1858 **Hygromia** *umbrosa* Adams, Genera of Moll., vol. ii., p. 215.
1833 *Helicella umbrosa* Fitz., Syst. Verz., p. 95.
1837 *Fruticicola umbrosa* Held, Isis, p. 914.
1837 *Bradybæna umbrosa* Beck, Ind., p. 20.

J. C. Dacie

HISTORY.—*Hygromia umbrosa* (*umbrosa*, living in shady places), was first discovered by Herr Ziegler, who collected numerous specimens in Austria, especially on the islands in the R. Danube near Vienna. The name was applied by Partsch in the Mus. Cæsar. Vindob. and adopted by Carl Pfeiffer, in his classical work on the German Mollusca.

It was first found in the British Isles in a living state by Mr. J. C. Dacie, of London, a devoted student of the *Littorinidæ*, who, when spending a holiday at Margate, in East Kent, found several specimens associated with *Hygromia striolata* and other species in the immediate vicinity of that place. I feel a pleasure in associating this species with its discoverer in this country.

Mr. Dacie was at first inclined to regard the shells as a somewhat peculiar variety or form of *H. striolata*, and as such exhibited them at a meeting of the London branch of the Conchological Society; the members present were, however, so much impressed with the peculiarities presented by the shells that Mr. Dacie was requested to send them to me for examination.

On communicating my opinion of its identity to Mr. Dacie, he paid a special visit to the spot, at the earliest possible moment, to endeavour to obtain living examples for the examination of the animal and its internal organization; but in this, owing perhaps to the lateness of the season and possibly not very favourable weather, he was unsuccessful.

A prior record exists of its discovery in a fossil state in the Pleistocene deposits within the Ightham fissure, West Kent, but this record was made in error.

This species is stated to be *H. rugosiuscula* of Sabatier, not Michaud, and was, according to Dr. Pfeiffer, regarded as *H. concinna* var. *a* of Jeffreys by Beck.

In referring this species to the sub-genus *Trichia* Hartm., I have in the absence of practically all knowledge of its internal structure, adopted the classification approved by Prof. v. Martens and other esteemed authorities.

Diagnosis.—*H. umbrosa* may be distinguished from *H. striolata*, with which it is most likely to be confounded, by its thin semi-translucent shell, granulate sculpture, wide umbilicus, and very oblique aperture, with reflected and practically approximating margins.

INTERNALLY, little is known of its structure, but while *H. striolata* always possesses a pair of gypsobela or love-darts, the present species has never more than one, which is described as straight and pointed, of a conical shape, and longer than that of *Eulota fruticum*.

Description of Animal.—Bielz describes the ANIMAL as yellowish-grey, with darker HEAD and DORSUM; MANTLE beset with black spots.

Description of Shell.—SHELL depressed, spire only slightly elevated; WHORLS 5½, slowly increasing in size, the last gradually but considerably deflected as it approaches the aperture, and thus bringing about an approximation of the mouth margins; greenish, corneous, or reddish in colour, thin shelled and translucent,

FIG. 95.

FIG. 96.

FIG. 95.—*Hygromia umbrosa* Partsch, × 2. Margate, Kent, Mr. J. C. Dacie.
FIG. 96.—Highly magnified shell sculpture of *H. umbrosa*, from photograph by Mr. W. Bagshaw.

with a blunt though perceptible carination, and showing a fine, rounded striation. It is also delicately but distinctly granulate in interrupted, wavy, oblique series, which are directed in an opposite direction to and cross the lines of growth, while Merkel says it is sparingly clothed with delicate hairs. APERTURE very oblique, with expanded margins, and sometimes showing a delicate and slender submarginal RIB. UMBILICUS very wide and deep. Diam., 11 mill.; alt., 5 mill.

Geological Distribution — *Hygromia umbrosa* has not yet been found in any deposit older than Pleistocene.

PLEISTOCENE.—In the British Isles, Messrs. Kennard and Woodward have recorded that Mr. W. J. L. Abbott found four specimens, two of which were immature, in the celebrated fissure at Ightham, Kent, but the record was afterwards found to be erroneous.

In Germany, Prof. Sandberger has recorded its presence in the Mid-Pleistocene tufa deposits of Weimar, and the valley loess of Leuben near Lommatzsch, and Robschutz near Dresden, Saxony, also in tufa at Weimar, from which latter place he also records it from Upper Pleistocene deposits.

Variation.—Rossmässler has named a var. *minor* of this species, and I have distinguished by the name *rubra* the "beautiful reddish variety" described by Dr. L. Pfeiffer.

I have also followed Dr. Westerlund in regarding several species described by Dr. Servain as probably local forms of *H. umbrosa*.

Dr. Slavik remarks that Bohemian specimens are smaller than those from more southerly countries.

VARIATION IN FORM OF SHELL.

Var. **aporata** (Bouguignat ms. 1879) Servain.

Helix aporata Servain, Ann. Malac., 1881, vol. i., p. 356.

SHELL more narrowly umbilicated, spire more depressed, whorls somewhat more rapidly increasing, the last comparatively large, aperture almost spherical, abruptly and strikingly deflected, and the margins very convergent. Diam., 12–13 mill.; alt., 6½ mill.

Dr. Servain states this form was originally sent to M. Bourguignat from Agram, Croatia, as *H. erjaveci*.

Austro-Hungary—Agram, Croatia, and Serajevo, Bosnia (Westerlund, l.c.).

Var. **œcoscia** (Bourguignat ms. 1879) Servain.

Helix œcoscia Servain, Ann. Malac., 1884, vol. i., p. 359.

Umbilicus very wide and funnel-shaped, whorls small, cylindrical, and almost subcarinate; aperture small, almost circular, margins almost continuous, thin, and expanded.

According to Dr. Servain, the Croatian specimens have been erroneously referred to *H. erjaveci*, and the Polish shells to *H. striolata* by various observers.

Austro-Hungary—Agram, Croatia (Servain, l.c.).

Russia—Ojcow, Poland (Westerlund, Palæarct Moll., 1889, p. 44).

Var. **umbrosella** (Jousseaume ms. 1883) Servain.

Helix umbrosella Servain, Ann. Malac., 1884, vol. i., p. 358.

Shell more depressed, umbilicus wider, aperture less oblique, less deflected, but relatively larger, and its margins stronger and more expanded.

This form was discovered in 1883 by Dr. Jousseaume, who provisionally gave it in ms. the name it now bears.

Austro-Hungary—Banks of the river Salzach, Salzburg (Servain, l.c.).

Var. **amela** (Bourguignat ms. 1879) Servain.

Helix amela Servain, Ann. Malac., 1884, vol. i., p. 360.

Shell more depressed but scarcely so large as var. *œcoscia*, umbilicus excessively dilated (4 mill. wide), whorls 6, subangular, very small and vermiform, slowly increasing in size and compactly coiled, the last not large, with a very slight deflection at the aperture, which is of an oblong shape with a thin peristome uniformly expanded and almost continuous.

This is said to be an extreme form of the var. *œcoscia*, and is remarkable for its very narrow and closely coiled vermiform whorls.

Austro-Hungary—Carniola (Westerlund, l.c.).

VARIATION IN SIZE OF SHELL.

Var. **sciraia** (Bourguignat ms. 1879) Servain.

Helix sciraia Servain, Ann. Malac., 1884, vol. i., p. 359.

Shell larger than *H. umbrosa*, with a more open umbilicus, and whorls more rapidly increasing in size, and remarkable for the slow and gradual deflection of the last whorl, the deflection originating half-a-whorl from the aperture, which is almost circular, the peristome is direct, and only slightly reflected basally.

The shell figured as *H. umbrosa* by Rossmässler in his Iconographie, fig. 424, to a certain extent represents this form in its size and contour.

Austro-Hungary—Croatia.

Var. **minor** Rossmässler.

Shell smaller, paler, with a narrow umbilicus.

This, according to Prof. Brusina, is the most common form in Croatia; it is smaller than the type, darker in colour, with a less reflected peristome, and said to serve as a passage to *H. hispida*.

The var. *minor* Brusina, according to Dr. Servain, does not, however, appertain to *H. umbrosa*, but to the group of *H. circinnata*, and is the *Helix mabara* of Bourguignat.

CONTINENTAL DISTRIBUTION.

Austro-Hungary—Recorded by Gallenstein as plentiful in the garden of the Benedictine College, Klagenfurt, Carinthia; by Prof. Brusina from Styria, and from the banks of the Save and Una, Croatia; and by Rossmässler from Tharand, Saxony, and from Gunzberg, Suabia.

VARIATION IN COLOUR OF SHELL.

Var. **rubra** Taylor var. nov.

Shell of a "beautiful reddish" colour.

Austro-Hungary—Recorded by Dr. L. Pfeiffer from the Monchberg, Salzburg.

Geographical Distribution.—*H. umbrosa* is another illustration of the expulsion of a subdominant or weaker species from an active evolutionary area, its present known range partially encircling the Germanic area, within which it is practically confined to the montane regions.

In the elevated wooded region of Lauban, Silesia, it has been observed to frequent *Geranium robertianum*.

H. umbrosa is not known in France, Scandinavia, Italy, or the Iberian Peninsula, but it is possible this may arise from oversight.

BRITISH ISLES.

Kent E.—Discovered associated with *H. striolata* in Sept. 1914 on the outskirts of Margate, near the depôt for the town's refuse, by Mr. J. C. Dacie. It was previously erroneously recorded in the fossil state from the Ightham fissure, West Kent.

FIG. 97.—Geographical Distribution of *Hygromia umbrosa* (Partsch).

Probable Range Recorded Distribution

GERMANY.

Distributed in the alps of South and Mid Germany, over the elevated plateaus of Bavaria and Suabia, the upper drainage system of the Elbe in Saxony, and the Harz Mountains, and has been recorded from Baden, Bavaria, Lusatia, Merseburg, Posen, Reuss, Saxony, Silesia, Suabia, Thuringia, Wurtemburg, and Dantzig, West Prussia.

AUSTRO-HUNGARY.

Herr Clessin describes *H. umbrosa* as inhabiting the whole region, and it is stated to inhabit the entire range of the Austrian Alps, the Erzegebirge, the Isergebirge, the Böhmerwald, the Upper Elbe region of Bohemia, the Danubian valley from Regensburg to Belgrade, and the valley of the Save.

The following countries are specifically recorded as inhabited by this species: Austria, Bohemia, Bosnia, Carniola, Carinthia, Croatia, Galicia, Goritz, Hungary, Moravia, Salzburg, Servia, Slavonia, Styria, Transylvania, and the Tyrol.

SWITZERLAND.

Herr Clessin records that this species is found throughout the country.

DENMARK.

Zealand—Recorded by Dr. Mörch from a garden at Bisserup, Holsteinborg; and Herr Steenberg mentions a single fine example (14 mill. × 7 mill.), larger than the German shells, found amongst *H. strigella* at Bisserup Haven by Pastor Jacobsen.

RUSSIA.

Poland—Recorded from Ojcow by Dr. Westerlund.

GENUS *ASHFORDIA* Taylor (nov. gen.).

HEREWITH a new genus is instituted for the reception of the *Helix granulata* of Alder, whose internal structure is so strikingly different from that of *Hygromia* that they cannot logically be grouped together, although the shells are so similar in their general aspect.

The name *Ashfordia* is here proposed to emphasize the peculiarities presented by the typical species and also to honour and perpetuate the memory of the late Mr. Charles Ashford, of Christchurch, the well-known and skilful malacological anatomist, who first demonstrated the distinctive character of its organization.

The very close convergence in external aspect of *Ashfordia* and certain species of *Hygromiæ*, due to their adoption of a similar mode of life, has hitherto led to their being universally but incorrectly associated together, a proceeding which their divergent organization clearly forbids.

The ANIMAL, which offers no special features, is pale and translucent, faintly granulate, and besprinkled with minute opaque-whitish dots.

The SHELL of *Ashfordia* is characteristically globose, of a thin, somewhat translucent, and feebly calcified texture, showing no trace of the paler peripheral zone occasionally present in *Hygromia*, and the whole surface is beset with numerous long, erect, and persistent whitish hairs arising from a bulbous base and arranged in oblique rows which cross the lines of growth; the umbilicus is very narrow, and partially overshadowed by the reflection of the columellar margin; and the peristome is thin and simple, with a weakly developed white submarginal rib.

INTERNALLY, this genus is broadly separated from *Hygromia* and the typical *Helices* generally by the right tentacular retractor having its course quite to the left of the genitalia and free from entanglement with them.

The genitalia are reduced by atrophy to an almost primitive simplicity, the dart sacs, mucus glands, etc., which undoubtedly were formerly possessed, having become lost by degeneration; the penis-sheath is short and bulky, possibly harbouring a fleshy egersidium or excitatory organ, and is prolonged into an epiphallus, terminated by a short flagellum.

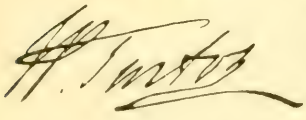
The JAW is very broad and deeply lunate, divided into two distinct areas, the broad upper part being colourless and translucent, while the hardened chitinous, and amber-coloured lower area is comparatively narrow, tapering off at the ends; there are numerous slight, flat, outwardly convex divergent ribs, which extend quite across the jaw and slightly crenulate the margins, with occasionally a median projection on the cutting-edge.

The RADULA as exemplified in the type species is quite distinctive in character from *Hygromia*, and remarkable for the feebly developed ectocones of the median series and for the strong bifid mesocone and the bi- and tri-furcation of the ectocones of the marginal teeth.

The geographical range and the species which may be ultimately allocated to this group are alike still problematical, as it is not certainly known to occur outside the British Isles, and additions to the group awaits careful anatomical study of the probably allied continental species.

Ashfordia granulata (Alder).

1830 *Helix* **granulata** Alder, Trans. Nat. Hist. Soc. Northumberland, vol. i., p. 39.
1833 — *globularis*, Jeffreys, Linnean Trans., vol. xvi., p. 507.
1803 — *hispida* Montagu, Test. Brit., p. 423, pl. 23, f. 3.
1862 — *sericea* Jeffreys, Brit. Conch., vol. i., p. 202, pl. xii., f. 4.
1852 *Teba hispida* Leach, Syn. Moll., p. 98.



HISTORY.—*A. granulata* (*granum*, a grain) has ever been and still is misunderstood by continental conchologists owing to the prevailing ignorance of its structure and the similarity of its shell to that of other not closely allied species, with which it has been so frequently confused, that its distribution is still quite uncertain, and though doubtless inhabiting the European continent, we have few or no really certain grounds for saying that it is found elsewhere than in the United Kingdom, though there are many more or less unreliable records of its occurrence in other lands.

This species is associated with Dr. William Turton, author of the "Manual of the Land and Freshwater Shells of the British Islands," and other important works, by whom it was detected, differentiated, and provisionally named prior to its discovery by Mr. Alder.

The portrait of Dr. Turton, herewith given from the title-page of the "Conchological Dictionary," is in the form of an ornament constituted by two facial profiles, a right and a left, placed *vis à vis* and separated by a dark background, which represents a classical vase, whose two sides form the facial outlines of Dr. Turton.

This species, so very distinct anatomically, was first noticed in 1803 by the famous Colonel Montagu, who, however, confused it with the *Helix hispida* Linné. It was next observed by Dr. Turton, who recognized its distinguishing characters, and applied to it the ms. name of *granulata* to express its most striking peculiarity. Later it was independently discovered near Newcastle by Mr. Joshua Alder, and described by him in 1830 as *Helix granulata*, the name suggested to him by Dr. Turton.

In 1833 Dr. Gwyn Jeffreys proposed to rename the species *Helix globularis* on the ground that Alder's name was not an appropriate one, as it expressed an imperfect appearance of the shell, an objection which Mr. Alder sufficiently refuted.

The present species has also from time to time been regarded by various continental and British conchologists as synonymous with *Helix hispida* L., *H. sericea* Müll., *H. sericea* Drap., *H. albula* Studer, *H. piligera* Ziegl., *H. rubiginosa* Schmidt, etc., but it is very probable that all these are incorrect and unwarranted associations.

The species is here removed from close association with *H. hispida* and the *Hygromiæ* generally on account of its internal organization being in such a different and much more degenerate or secondarily simplified stage of development, and the right tentacular retractor being free from entanglement with the genital complex, that they cannot consistently be closely associated or classified together, and I have, therefore, adopted the generic name *Ashfordia* to better emphasize the differences it presents.

Diagnosis.—This species may be distinguished from *H. hispida*, which testaceologically it most closely resembles, by its more distinctly globose form, its thinner substance, whiter colour, minute umbilicus, and the hairy investment being chiefly formed by long straight hairs.

INTERNALLY, it differs from that species and its allies by the secondary simplification the reproductive system has undergone, evidenced by the total absence, probably by degeneration, of many of its accessory organs, as dart sacs, mucus glands, etc., which are so characteristic of the *Hygromiæ* and the typical Helices generally.

Description.—The ANIMAL varies slightly in colour, but is usually whitish and translucent, though yellowish anteriorly, and becoming greyer towards the head, the foot yellowish, the whole body is indistinctly granular and besprinkled with small opaque-white specks ; OMMATOPHORES not very slender, of a somewhat translucent iron-grey, through which the blackish RETRACTORS are clearly visible, and their continuation being also perceptible for some distance on each side of the dorsum ; EYE-SPECKS black ; MANTLE pale with black marblings and fleckings.

The SHELL is very globose, spire well produced, greyish or yellowish-white in colour, and subhyaline, sometimes slightly tinged with rufous near the aperture, extremely thin yet firm in substance, beset with erect and persistent whitish hairs, arising from minute bulbous or tubercular bases, which impart a granular aspect like shagreen to the shell surface, and when the hairs become lost the position being indicated by their empty sockets; the LINES OF GROWTH are very fine, with still more delicate intermediate STRIÆ, while faint traces of a spiral striation are occasionally perceptible under high magnification; WHORLS 5½ to 6, very convex, and slowly increasing in size; APERTURE lunate, and in fully adult shells with a thin internal submarginal rib ; LIP thin, scarcely deflected above and very feebly reflected, but clearly perceptible around the UMBILICUS, which is very narrowly perforate. EPIPHRAGM very thin, transparent, and iridescent in summer, becoming more calcified and opaque in winter.

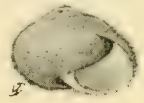


FIG. 100.

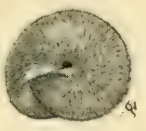


FIG. 101.

FIG. 102.

FIG. 100.—Frontal aspect of *A. granulata*, × 2, near Bristol, Miss F. M. Hele.

FIG. 101.—Basal aspect of *A. granulata*, ×2, Mostyn, Flint, Mr. W. Denison Roebuck.

FIG. 102.—Hairs from surface of body-whorl of *A. granulata* (from a highly magnified photograph by Mr. W. Bagshaw).

Diam., 7½ mill. ; alt., 5 mill. Average weight of adult shells about $\frac{3}{50}$ths grain.

When containing the animal the underside of the shell is usually uniformly yellowish, though sparse blackish marblings are occasionally present, but along the periphery of the last whorl the elongate and very pale linguiform RENAL ORGAN is clearly visible ; its base adjoins the shell aperture, and is defined by a black patch. The upper side shows a pale nucleus, usually destitute of hairs, the following 3 or 3½ whorls show a whitish ground colour irregularly spotted and flecked with black and brown, which become most dense as they approach the apex or nucleus.

INTERNALLY, the right TENTACULAR RETRACTOR lies entirely to the left of and is not entangled with the sexual apparatus as in the typical *Helices* ; the HEART shows a transparent yellowish-grey auricle, and an opaque whitish-grey ventricle ; and the hepatic artery is quite indistinct.

The ALIMENTARY SYSTEM shows a long and narrow ŒSOPHAGUS, but the slender ducts of the SALIVARY GLANDS are of moderate length, the lobulate secretory sections being closely appressed to the œsophagus and to the proximal portions of the crop ; the somewhat voluminous STOMACH and CROP are apparently continuous without any obvious division and brown in colour, the intestinal fold is olive-green, the rectum leaden-grey, and the hepatic section quite pale, showing conspicuously against the very dark olive-brown LIVER.

The REPRODUCTIVE ORGANS consist of a somewhat compact and narrowly triangular OVOTESTIS which is constituted by an aggregation of whitish CÆCA ; the HERMAPHRODITE-DUCT becomes much convoluted as it approaches the distinct VESICULA SEMINALIS ; the ALBUMEN GLAND is of the usual linguiform shape ; the OVIDUCT is very sacculate ; the SPERM-DUCT or prostate is conspicuously broad, and composed of loose, short, opaque white rods ; the SPERMATHECA is large and somewhat triangulate, supported by a stoutish stem about half the length of the oviduct ; the VAGINA, though somewhat dilated, shows no traces of the dart-sacs

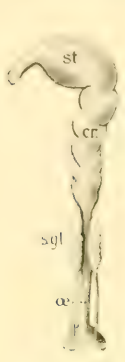


FIG. 103.

FIG. 104.

FIG. 105.

FIG. 103.—Stomach, crop, œsophagus, and salivary glands of *A. granulata* Alder, greatly enlarged.
cr. crop ; *œ.* œsophagus ; *s.gl.* salivary glands ; *st.* stomach.

FIG. 104.—Sexual organs of *A. granulata* Alder, × 3.
a.g. albumen gland ; *ep.* epiphallus with retractor ; *fl.* flagellum ; *ot.* ovotestis ; *ov.* oviduct ; *p.* penis sheath ; *s.d.* sperm duct ; *sp.* spermatheca.

FIG. 105.—Enlarged distal end of oviduct in *A. granulata* Alder.
alb.gl. albumen gland ; *h.d.* hermaphrodite duct ; *ov.* oviduct ; *s.d.* sperm duct ; *v.s.* vesicula seminalis.

and mucus-glands which at one time were probably present ; the PENIS-SHEATH is very tumid and abruptly dilated at its junction with the ATRIUM, its distal end is longitudinally striped with opaque-white lines, and separated from the proximal moiety by a slight constriction, the tumidity of the organ suggests the possibility of the presence therein of a sarcobelum or excitatory organ ; the EPIPHALLUS is fairly long and cylindrical, the PENIAL RETRACTOR being affixed near its proximal end ; the FLAGELLUM resembles a short spike.

The RADULA is of the usual oblong shape, about 2 mill. long and $\frac{3}{4}$ mill. wide, with an average of 120 sinuate, transverse rows of teeth, each row composed of the usual three series, the median, the lateral, and marginal areas. The median

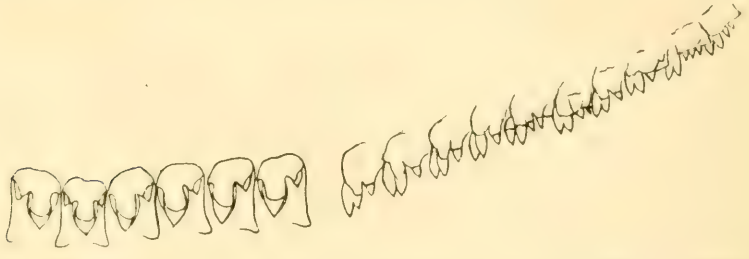


FIG. 106.—Representative teeth from half a transverse row of the radula of *Ashfordia granulata* (Alder) from Radlett, Herts., photographed by Mr. W. Bagshaw, from a preparation by Rev. E. W. Bowell (highly magnified).

row is characterised by a somewhat quadrate base, possessing a moderately developed mesocone, with a feeble and insignificant ectocone at each side ; the laterals are about ten in number, and show a mesocone which increase in size and strength and whose ectocone also increases in size as the teeth recede from the centre, while the endocone is only indicated ; the marginals are about fifteen in number, and are

Distribution of *Ashfordia granulata* (Alder)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lanes
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

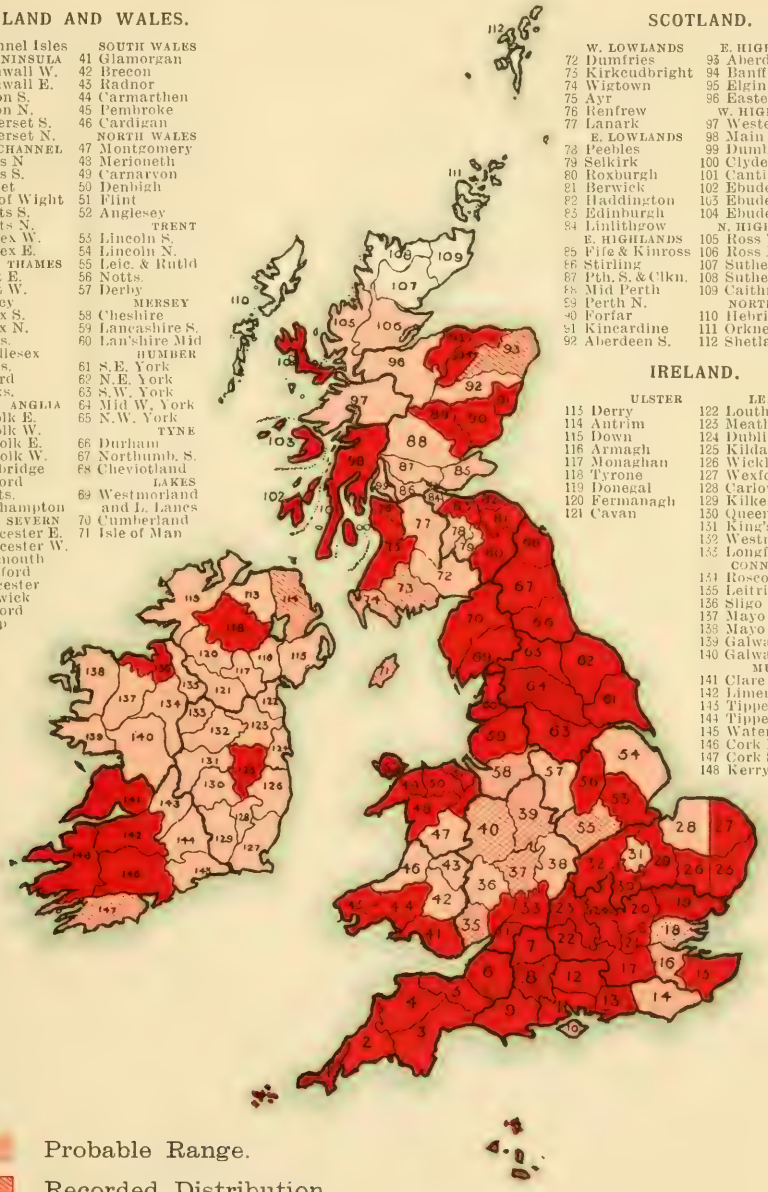
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

generally trifid, due to the splitting of the mesocone, but as the edge of the membrane is approached the ectocone is also split into two or even three subsidiary points.

The formula of a specimen from Radlett, Herts., collected and prepared by the Rev. E. W. Bowell, and photographed by Mr. W. Bagshaw, is

$$\frac{1}{3}\frac{5}{5} + \frac{1}{2}\frac{0}{2} + \frac{1}{3} + \frac{1}{2}\frac{0}{2} + \frac{1}{3}\frac{5}{5} \times 120 = 6{,}120 \text{ teeth.}$$

The JAW or mandible is unusually broad, and deeply arcuate in shape, with bluntly tapering ends, and occasionally showing a rounded median rostration on the lower margin; it is of a colourless appearance, and apparently of somewhat cartilaginous consistency, except along the cutting margin, which is of an amber colour, indicative of the greater chitinization, strength and hardness of that part; there are twenty or more flat, outwardly convex, divergent ribs, which extend quite across the jaw and slightly crenulate or undulate the lower margin.

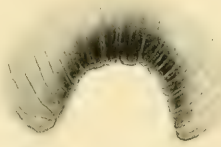


FIG. 107.—Mandible of *A. granulata*, greatly enlarged (from a photograph by Mr. W. Bagshaw of a preparation by Rev. E. W. Bowell).

Reproduction and Development.—Nothing appears to be known respecting the amours of this species, excepting that the seminal element is transferred by means of a closely serrate spermatophore during congress; its presence in the spermatheca being indicated by the distortion of the sac, caused by the gradual hardening of the capreolus. The eggs have been observed to be deposited during the months of October and November; they are globular in shape, slightly more than a millimetre in diameter, and at first of a slightly transparent white, but on exposure to the air become opaque white, one portion showing of a whiter hue than the rest of the shell; the envelope also becomes brittle, and cracks and breaks like the egg of a fowl.

FIG. 108.—Head of spermatophore of *A. granulata*, taken from the spermatheca shortly after pairing, greatly enlarged.

The winter is probably passed through in the egg state, the hatching taking place in the early spring, the creatures mostly attaining full growth in the late autumn months.

After the deposition of the eggs it is probable that the adult animals die during the succeeding winter, a fate also shared by those individuals which have not attained maturity, as few or no mature shells can be found during the spring months.

Food and Habits.—*A. granulata* appears to be a hardy species, and unusually active in the colder days of the late autumn when the temperature ranges between 30°—40° Fahr., and also appears in the milder intervals in winter. After continued moderate frost and in severe weather it buries itself temporarily beneath matted herbage and similarly sheltered positions, finding this a sufficient protection against 2° or 3° of frost. The epiphragm, which is usually thin and delicate, becomes more opaque under these conditions. Its characteristic habitat is stated to be the margins of ash-woods, especially if close by a low ash or hazel copse; in such places it is found, according to Messrs. Kendall and Dean, in large colonies on the silverweed (*Potentilla anserina*) and other plants. It clings very loosely to the leaf or branch on which it may be crawling, falling instantly to the earth or amongst the ground herbage at the slightest touch or at the first indication of danger.

In other localities it is plentiful on or among *Equisetum fluviatile*, *Eupatorium cannabinum*, dog's mercury (*Mercurialis perennis*), etc.; while nettle (*Urtica dioica*), common alexanders (*Smyrnium olusatrum*), coltsfoot (*Tussilago farfara*), bramble (*Rubus* sp.), bedstraw (*Galium aparine*), butter-bur (*Petasites vulgaris*), and other plants have been observed to be preferred in special districts; and even waste paper and rusty iron are attractive and resorted to.

It is occasionally so abundant that it actually swarms and thousands of individuals may be congregated within a very limited area, and every plant, stem, or leaf of ivy and other vegetation be so crowded that they are compelled to crawl upon and over each other when changing their location.

A. granulata prefers the damp or boggy ground by or near the margins of ponds, streams, ditches, rivers, etc., and in such situations may often be found plentifully on the grass and rushes, or under and amongst the dead leaves of *Phragmites* and other rank herbage.

The circulation of this species would appear to have an average pulse-rate in summer of about 40 contractions per minute when the animal is in repose, increasing to 50—55 per minute when crawling, but occasionally this acceleration may become much more pronounced.

During very hot weather the pulsations may rise even in repose to 64 contractions per minute, while the lowest winter rate observed by Mr. Ashford was 9 contractions per minute at a temperature of 28° Fahr.

Dr. Gain who kept many specimens in captivity found that although none of the foods offered were ravenously devoured, yet the foliage of the potato, dandelion (*Taraxacum officinale*), groundsel (*Senecio vulgaris*), lettuce (*Lactuca sativa*), cabbage (*Brassica oleracea*), elm (*Ulmus campestris*) and scarlet runner bean were freely eaten, while withered red clover (*Trifolium pratense*) was also readily devoured, and *Persicaria*, white turnip, and cooked potato were taken less willingly, but cornbine, speedwell (*Veronica officinalis*), white dead-nettle (*Lamium album*), creeping loosestrife, caper spurge, beet, and *Boletus edulis* were only nibbled after several days starvation.

In a state of nature Mr. G. R. Tate records that about Alnwick it feeds principally on *Equisetum telmateia*; while Mr. Step states that in Cornwall it had a weakness for the harts' tongue (*Scolopendrium vulgare*).

Parasites and Enemies.—In addition to being liable to be picked up and devoured by the more indiscriminate enemies of molluscan life, it has been noted as fed upon by mice, numerous gnawed shells of this species being found in their runs at Oreston, near Plymouth, by Mr. L. E. Adams.

A little Acarid, probably *Philodromus limacum*, was observed infesting a specimen collected at Killarney by Dr. R. F. Scharff.

Geological Distribution.—*A. granulata* is recorded by Dr. Jeffreys as occurring in the "Upper Tertiaries" of this country, but I have not hitherto found this confirmed by any other author.

Owing to the misconception of this species being so general on the continent, there are no reliable records available for other countries.

Pleistocene.—In North Essex, Messrs. Kennard and Woodward have recorded it from Copford.

Holocene.—In West Cornwall, Messrs. Kennard and Warren record it from Holocene sand and other situations on the summit of Towan Head near Newquay; and Mr. J. P. Johnson from Riviere Towans near Camborne.

In West Sussex, it has been found by the Rev. W. A. Shaw in a deposit near West Stoke, Chichester.

In South Essex, it is recorded by Messrs. Kennard and Woodward from the alluvial shell marl of the River Lea, Walthamstow.

In North Essex, it is recorded as *H. sericea* Müll. from the shell marl at Felstead by Mr. J. French; and by Mr. R. Miller Christy as rare in alluvial shell marl and black earth and peat on the banks of the River Camm, Chignal St. James.

In Oxford, it is recorded by Messrs. Kennard and Warren from a deposit on the banks of the Thames at Clifton-Hampden.

In Yorkshire, Mr. J. Wilfrid Jackson has found it sparingly in the alluvial earth of the Ribble Valley at Great Mitton.

Variation.—*A. granulata* does not exhibit a great range of variation; many varieties have, however, been attributed to this species which in all probability belong to *Hygromia hispida* and its related forms, with which the present species has been so long confounded and with which it has no very intimate structural relationship.

It is curious to note that the specimens from the Isle of Skye in the north of Scotland are much more depressed in shape than southern shells, approaching in this respect *Hygromia hispida* which it apparently to some extent replaces in the north of Scotland.

In South Wales, on the North Cliff, Tenby, the shells are stated to be very thin and only sparingly hirsute; while those from the Land's End in the extreme west of Cornwall are remarkable for being often found in a soft and collapsible state, doubtless an effect of the absence of limestone in that region.

VARIATION IN FORM OF SHELL.

Var. **carinata** Taylor.

Helix sericea var. *carinata* Taylor, Journ. of Conch., vol. iv., p. 31, 1883.

Fig. 109.—*A. granulata* var. *carinata* Taylor, × 3, Addingham near Ilkley, Yorks.

SHELL sharply angulated at the periphery. Aperture, diam. 4 mill.; alt. 2½ mill.

ENGLAND.

Surrey—Almshouse road, Haslemere, Chas. Pannell, Journal of Conchology, vol. x., p. 173.

York Mid W.—Banks of the River Wharfe, near Addingham (Taylor, l.c.).

VARIATION OF SUBSTANCE OF SHELL.

Var. **cornea** Jeffreys.

Helix sericea var. *cornea* Jeffreys, Brit. Conch., 1862, vol. i., p. 202.

SHELL horn colour, very thin, glossy, and semi-transparent, the labial rib perceptible on the outside.

On St. Mary's, and other of the Scilly Isles, this variety grows to a good size, and is the prevalent form there, the extreme tenuity of the shells being probably due to the islets being entirely granitic, while at the Land's End, West Cornwall, where the geological formation is granite and shale, the tenuity is so extraordinary that the shells living there are quite soft and collapsible and little more than a chitinous film.

Dr. T. Scott has observed that at Tarbert the var. *cornea* was found indifferently under stones, or on grass, nettles, cow parsnip (*Heracleum sphondylium*), and beaked parsley (*Anthriscus sylvestris*).

ENGLAND AND WALES.

Scilly Isles—St. Mary's, Tresco, and other islets, July 1875! W. H. Hatcher.

Cornwall W.—Abundant, St. Ives, Sept. 1885! J. E. Mason. Newquay! Truro! and Falmouth! J. H. James, 1888. Land's End, C. E. Wright.

Devon S.—Paignton, Aug. 1884! Sydney C. Cockerell. Torquay, scarce, Aug. 1888! Loftus St. George Byne.

Devon N.—Combe Martin, E. Collier, 1886.

Dorset—Lulworth (Jeffreys, Brit. Conch., vol. i., l.c.).

Hants N.—Preston Candover, Oct. 1883, Rev. H. P. Fitzgerald. Swarraton, Jan. 1886! Rev. W. L. W. Eyre.

Suffolk W.—On the banks of the River Lark, Mildenhall ! A. Mayfield.
Norfolk E.—Costessey Common (Pearce and Mayfield, J. of C., vol. vii., p. 396).
Carmarthen—Common under moss in damp places on the sandhills, Laugharne, Sept. 1883 ! C. Jefferys.
Pembroke—Castle Cliff, Tenby, moderately plentiful under herbage, Sept. 1872, G. Sherriff Tye, J. of Conch., vol. i., p. 30.
Carnarvon—In profusion on the cliffs quite down to the edge of the sea, Nevin, Aug. 1910, F. H. Sikes.
York S.W.—Canal banks between Keighley and Silsden, Oct. 1912 ! F. Booth.
York Mid W.—Hackfall, March 1880 !
Westmorland and Lake Lancashire—Abundant and fine amongst grass in pasture near Eggerslack Wood, Grange; also at Meathop on long grass and Meadowsweet, J. Wilfrid Jackson.

SCOTLAND.

Main Argyle—With type about Oban; very large on the Island of Lismore, Aug. 1893 (Standen and Hardy, J. of Conch., vol. vii., p. 271).
Cantire—Old Castle of Tarbert, April 1886 ! T. Scott.
Ebudes N.—Broadford and elsewhere in the Isle of Skye, Aug. 1910 ! F. Booth.

VARIATION IN COLOUR OF SHELL.

Var. **albida** Tye.

Helix sericea var. *albida* Tye, Quart. Journ. of Conch., vol. i., p. 30, 1874.

Shell milk-white.

It is worthy of remark that the known range of this beautiful albine form is strictly western in England and Wales, and no reliable record is yet known from any other district.

ENGLAND AND WALES.

Cornwall—Mr. Tye records a specimen from Cornwall.
Pembroke—Not very common, Narberth road, Tenby (Tye, l.c.).
Denbigh—Gloddaeth Woods, July 1883 ! W. Denison Roebuck.
Anglesea—Beaumaris, with type, Sept. 1881 ! L. E. Adams.

Geographical Distribution.—*A. granulata* is a very widely diffused but somewhat sporadic species in this country. In Cornwall and Devon and other western districts *A. granulata* is frequently the commonest and most plentiful species. According to our present knowledge, it ranges from Elgin and Skye in the north to the Channel Isles and Scilly Isles in the south.

Formerly this species was believed to be an absentee from the Channel Isles, but according to Mr. Rimmer it is plentiful in Guernsey, and Mr. J. R. le B. Tomlin has reported its occurrence in the Island of Sark. Probably it will eventually be found on the other islands also.

It is also found in Ireland, but its recorded distribution there is even more scattered and disconnected, but it would appear to be most widely distributed and common in the south-western region.

On the Continent, though recorded as inhabiting nearly all Europe, and specifically alluded to under its proper appellation or under that of one or other of its erroneously assumed synonyms, as a denizen of Germany, France, Belgium, Austro-Hungary, Switzerland, Italy, Spain, Portugal, Greece, Russia, Caucasus, and Algeria, extending in Asia to Irkutsk and the River Amur, yet it is more than probable that these records refer chiefly to *H. sericea* of Draparnaud, or to the various other species with which *A. granulata* has been so very generally confused, but as reliable figures and description of the shell and the internal organization of the animal are now available, it is hoped that a knowledge of its peculiarities will become more widely diffused and its true range quickly established.

Genus *THEBA* Risso.

(Teba, Leach; Zenobia, Gray; Carthusiana, Kobelt; Euomphalia, Westerlund).

S. P. Woodward

THE genus *Theba* has been adopted for the reception of *Helix cantiana* and *H. cartusiana*, and though these are the only constituent species found in the British Isles, many others occur in the Mediterranean region.

The names *Theba* and *Teba* are doubtless essentially the same, although Comm. Caziot regards Leach's name as meaning a hill, and that of Risso as having a different signification, yet the close association between Risso and Leach justifies the view, that in spite of the probably accidental orthographical difference, both names have the same significance and are presumably based upon the name of the ancient city of Thebes, which is rendered the more probable from the predilection of Dr. Leach for geographical, eastern, or biblical names, with no necessary connection with the objects to which the names were applied, as has been so clearly demonstrated by the Rev. G. A. F. Knight, and we have in further corroboration Dr. Jeffreys' authority for the statement that Risso did obtain the name *Theba* from Dr. Leach's ms.

With the present group I associate the late Dr. S. P. Woodward, one of the most eminent of British conchologists, and author of the classical work "A Manual of Recent and Fossil Mollusca," a work which was and is held in such high appreciation by the scientific world that it has run through several editions, and been translated into other languages, as well as formed the basis upon which similar works have been issued in France and elsewhere. In the domain of philosophical thought, he was, perhaps, the first or one of the first to suggest the probability of the existence of one chief evolutionary centre "from which the first and greatest types of life have emanated."

The genus *Theba* has a smooth, narrowly umbilicate and whitish shell, often faintly translucent, with faint sculpturing or delicate spiral lineation, and often exhibiting a pale supra-peripheral zone, analogous to and probably homologous with that of other Helicidians, and indicating their descent from a distinctly banded, far distant, but common progenitor.

Interiorly, the Thebæ possess a slightly arcuate and narrow jaw, with numerous flattened ribs, and with or without a slight medial rostration.

The genitalia show the most striking peculiarities; the penis-sheath is short and tumid, with a long, tapering epiphallus, a short flagellum, and no retractor; the dart and dart-sacs have undergone more or less degeneration, and in some cases their original form has become lost, and their functions have become transferred to the new organs into which they have become modified. As in *Ashfordia* the right tentacular retractor is free from entanglement with the genitalia, and the seminal products are transferred by means of an elongate and serrate spermatophore.

The group is widely distributed in Europe and the near East, and is somewhat improbably assumed by M. Fagot to have arisen in the Tauric region, and to only live within maritime influence.

Theba cantiana (Montagu).

1801 *Helix carthusiana* Draparnaud, Tabl. Moll., no. 29, p 86.
1803 — **cantiana** Montagu, Test. Brit., p. 422, and Suppl., p. 145, pl. 23, f. 1.
1803 — *pallida* Donovan, Brit. Shells, vol. v., pl. clvii., f. 2.
1840 — (*Hygromanes*) *cantiana* Gray's Turton's Manual, p. 144, pl. iii., f. 26.
1848 — *galloprovincialis* Dupuy, Hist. Moll., p. 204, pl. 9, f. 5.
1855 — (*Zenobia*) *cantiana* Moquin-Tandon, Hist. Moll., p. 201, pl. xvii., ff. 9–13.
1861 — *dacampi* Villa, Catalog. Sinom. Moll., p. 7.
1872 — *anconæ* Issel, App. Catal. Pisa, p. 8.
1826 Theba *carthusiana* Risso, Hist. Nat. Eur. Merid., vol. iv., p. 74.
1826 — *charpentieri* Risso, loc. cit.
1826 — *ecmenelea* Risso, loc. cit.
1826 — *rubella* Risso, loc. cit.
1831 *Teba cantiana* Leach, Syn. Moll., p. 94.
1837 *Fruticicola carthusiana* Held, Isis, p. 914.
1837 *Bradybæna cantiana* Beck, Ind. Moll., p. 19.
1878 *Eulota cantiana* Paulucci, Matériaux Faune Mal. Ital.

A. J. Schmidt

HISTORY. — *Theba cantiana* would appear to have been first observed by Dr. Martin Lister and cited by him in 1678 as a large variety of *Helix rufescens*, or as a distinct species found in Kent. In 1801 Draparnaud detected the species in the south of France, and described it under the name of *Helix carthusiana*, mistaking it for Müller's species of the same name; afterwards in 1805 it was figured and fully described in his "Histoire."

In 1803 our own countryman Colonel Montagu again brought the species forward, figuring and describing it under the name of *Helix cantiana*, by which appellation it is now generally known.

With the present species I associate the late Archidiaconus Adolf Schmidt, of Aschersleben, the venerable conchologist and malacological anatomist, who was the first to describe and carefully figure the organization of "*Helix galloprovincialis*," Dupuy, the south European form of *Theba cantiana*. He was also in his time the universally acknowledged authority upon the difficult genus *Clausilia*, upon which group he wrote several valuable monographs.

The portrait, for which I am indebted to Herr Paul Hesse, of Venice, represents the distinguished scientist in the eighty-fifth year of his age.

Dr. Kobelt was decidedly of opinion that *H. galloprovincialis* of Dupuy and *H. cantiana* of Montagu were two well marked species, but the figure of the internal organs given by A. Schmidt of a South European example quite coincides with that of British specimens of the typical form.

Helix iadolæ Bourguignat and the Corsican *Helix oustereæ, monerebia*, and *gaudefroyi* of Mabille have all been regarded as synonyms by authors of repute, while Dr. Kobelt has remarked that *H. frequens* Mouss., *H. anconæ* Issel, and *H. dirphica* Blanc are scarcely to be distinguished from

the true and characteristic *cantiana*, but the anatomy of the *H. dirphica*, as shown by Herr Paul Hesse, shows divergences.

Kickx and Van Beneden have, according to M. Colbeau, apparently confused this species with the *H. carthusianella* of Draparnaud.

Diagnosis.—*Theba cantiana* has its greatest affinity with *T. cartusiana*, which in this country is always so considerably smaller that size alone is a sufficiently distinguishing character.

From *Hygromia striolata*, with which it is sometimes confused, it differs in its larger and more globose form, its narrower umbilicus, more delicate striation, and the absence of the subcarinate periphery.

INTERNALLY, *T. cantiana* is sharply separated from its congener by the long and filiform sarcobelum, or excitatory organ, which has now lost all semblance of the stylophore and accessory sac, from which it has been evolved, and both of which, though in outward aspect only, still exist in *T. cartusiana*.

From *H. striolata* it is at once separated by the absence of twin-darts and dart-sacs, which are such striking objects in that species.

Original Description of *H. carthusiana* Drap.

Animal à peu près comme le précédent [*H. carthusianella* Drap.].

Coquille aussi semblable à la précédente, solide quoique mince, transparente, blanchâtre, irrégulièrement chagrinée ; mais elle est plus bombée et moins aplatie. On ne voit guère la ligne dorsale blanchâtre. L'ouverture est semilunaire, moins allongée et plus arrondie. L'ombilic est un peu plus ouvert. Le bord columellaire est un bourrelet de la même couleur au dedans, et une bande lactée au-dehors.

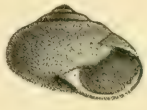


FIG. 112.—*H. carthusiana* (after Draparnaud).

Habite dans les champs.

DRAPARNAUD, Hist. Nat. Terr. et Fluv. France, 1805, p. 102, pl. vi., f. 33.

Description.—SHELL globosely depressed, rather thin and translucent, slightly glossy, and of a creamy-whitish colour, usually with a rufous flush on the underside of the shell and on the upper side towards the aperture; the same colouring is also often present at the termination of the periodic growths, and renders perceptible a supra-peripheral whitish zone, while in addition there is a broad whitish zone margining the suture of the body-whorl, and perceptible only on the rufous tinted portions ; the SCULPTURE is composed of irregular transverse STRIÆ with variably shaped malleations on the last whorl, while the upper whorls show a number of punctate depressions only perceptible under a lens, and possibly the vestiges of the short and somewhat recurved whitish hairs present in young and adolescent shells, but which disappear in the adult. WHORLS 6–6½, convex, increasing gradually in size, spire slightly raised, suture distinct ; APERTURE slightly oblique, and elliptically lunate, margined externally by a narrow brownish-grey area, beyond which and parallel to it is a pale reddish-yellow cincture almost two millimetres broad, which limits the duller rufous colouring characterizing the termination of the whorl. Internally, the aperture is furnished with a distinct white submarginal RIB, which is most prominent on the outer lip, and blends with the dilated COLUMELLAR MARGIN ; the palatal margin is thin, slightly reflected, and of a rufous shade, sharply defining the white rib, which is similarly margined at the inner side also. UMBILICUS small and narrow, and partially concealed by the reflected lip. Diam., 18 mill ; alt., 10 mill. Average weight of shell, 4·2 grains.

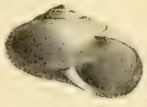


FIG. 113.—*H. cantiana* Mont. (after Dupuy).

ANIMAL with a comparatively elongate body, truncate in front, pointed and flattened behind, and the tail extending almost to the outer margin of the shell when crawling ; dull pale brownish dorsally, becoming paler and greyer as it recedes from the head ; the general tint is darker at the sides, although the tubercles are more closely sprinkled at their apices with minute whitish specks. The whole BODY is

tuberculate, and there are three longitudinal dorsal rows of oblong shape; the LATERAL GROOVES are only faintly indicated, and no facial grooves are perceptible; the MANTLE is deep grey, with paler veinings and specks, the margin of the pulmonary orifice dark grey; the OMMATOPHORES are dully hyaline, closely covered with minute black specks, giving them a greyish-black tint; they are widely divergent, and when fully extended are long, slender, and tapering, fairly bulbous at the apex, with black eye-specks; the LOWER TENTACLES are somewhat bulbous at the end, about one-third the length of the upper pair, but more hyaline and transparent, apparently owing to the fewer and paler spots upon them; the FOOT-SOLE is faintly trifasciate, due to the darker margins, when crawling the foot-fringe is distinctly separated by a groove and by its darker tint, due to the absence of the whitish spots present on the body generally; when not fully extended the foot is very sprawling; the locomotory slime is thin and colourless, though occasionally tinged with yellow. EPIPHRAGM is basally almost flush with the margin of the aperture, but on the upper margin is fixed inside the apertural rib; the summer epiphragm is a transparent film, with a somewhat opaque and whitish appearance in parts owing to delicate cretaceous particles being dispersed within or over its surface in an arborescent manner; the winter epiphragm is more calcareous, opaque, and solid.

INTERNALLY, the cream coloured KIDNEY or renal organ is very long, broadly triangular above, narrow and tapering below; as seen through the shell in life it joins the light patch so conspicuous on the underside of the body-whorl, but the russet-coloured arborescent veinings apparently spread over its outer surface belong to the mantle membrane and not to the kidney itself.

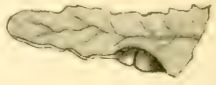


FIG. 114.—Heart and Renal organ of *Theba cantiana* Mont. greatly enlarged.

The REPRODUCTIVE ORGANS are chiefly remarkable for the apparent total loss of the dart-sac and its accessory gland and for the presence of an elongate CÆCUM opening into the atrium, which is probably evaginated prior to pairing, and acts as an egersidium or excitatory organ, and thus usurping the chief function of the lost dart.

The OVOTESTIS is composed of yellowish-white follicles in isolated groups and unilaterally arranged; the HERMAPHRODITE DUCT is distally straight and slender, becoming thick, white, and sinuate as it approaches the vesicula-seminalis; the

FIG. 115.

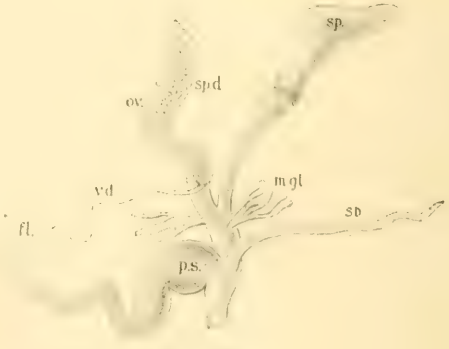


FIG. 116.

FIG. 115.—Reproductive organs of *Theba cantiana* Mont., × 3.
a.g. albumen gland; *d.* degenerate dart-sac or sarcobelum; *ep.* epiphallus.

FIG. 116.—Proximal end of the reproductive organs of *T. cantiana*, more highly magnified.
fl. flagellum; *m.gl.* mucus glands; *ov.* oviduct; *p.s.* penis sheath; *sb.* degenerate dart-sac, sarcobelum or excitatory organ; *sp.d.* sperm duct; *sp.* spermatheca; *v.d.* vas deferens.

ALBUMEN GLAND is elongately linguiform, and terminally narrow, of a clear yellow or pale amber, occasionally tinged with greenish, of a gelatinous consistency, and indistinctly lobular; the OVIDUCT is greenish-grey, closely sacculate, and sometimes forming a sort of ruffle at the base of the albumen gland; the PROSTATE or sperm-duct is of an opaque cream colour, or light ochreous, well defined, and somewhat broad below; PENIS-SHEATH tumid, of a whitish colour, tinged in places

Distribution of *Theba cantiana* (Mont.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles

PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.

CHANNEL
7 Wilts N.
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.

THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.

ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton

SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan

NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey

TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld
56 Notts.
57 Derby

MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid

HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York

TYNE
66 Durham
67 Northumb. S.
68 Cheviotland

LAKES
69 Westmorland and L. Lancs
70 Cumberland
71 Isle of Man

SCOTLAND.

W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark

E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow

E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness

W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.

N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness

NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

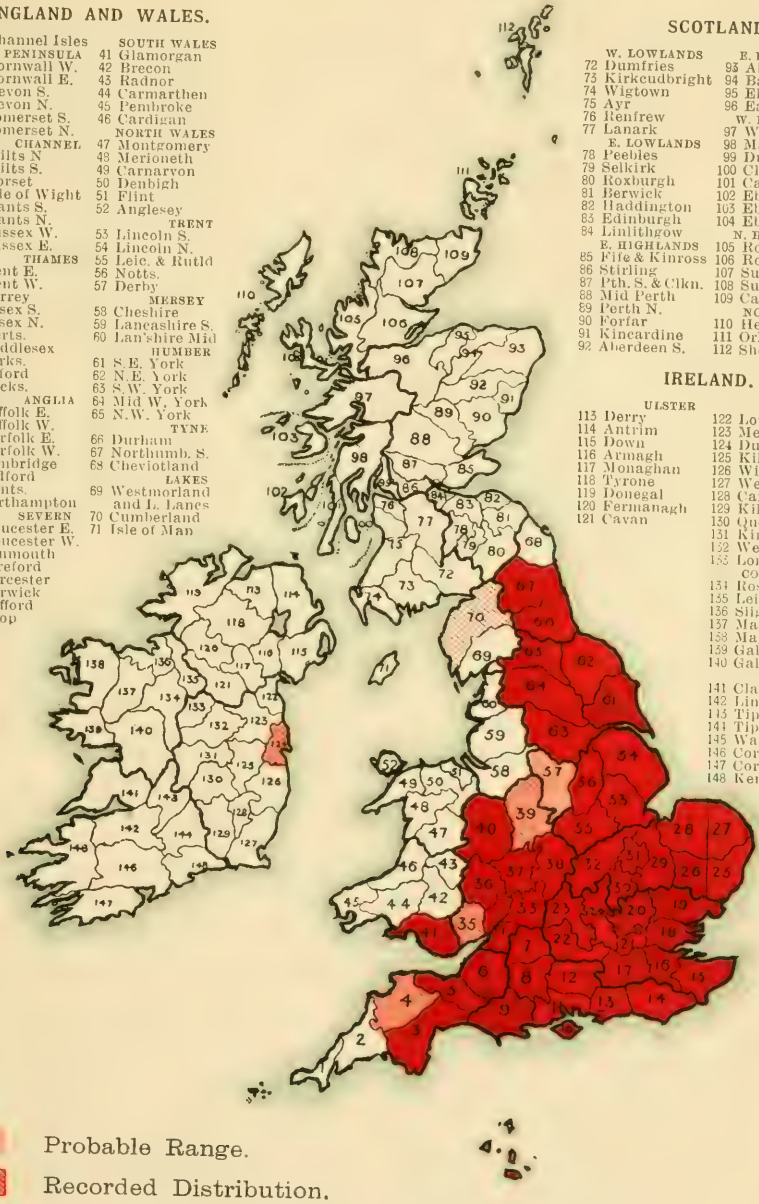
IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford

CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.

MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

with fawn, and longitudinally streaked with white, due to the foldings of the inner wall being visible through the investing tissues ; the EPIPHALLUS is long, tapering, and naturally somewhat twisted at its origin, and is terminated by a short and abruptly flexed FLAGELLUM ; there is no penial retractor muscle. SPERMATHECA very large, subtriangular, and whitish-grey, its stem pearly-white, with frequently a double inflation ; a vaginal MUCUS GLAND is present at each side of the vagina, each with three to five vermiform, semitransparent opaline branches, resulting from two repeated bifurcations ; near the external aperture and opposite the penial opening there is a slender and tapering CÆCUM, 20 or more millimetres in length; this is probably an egersidium or excitatory organ, and represents and replaces the function of the lost dart; it is of an opaline azure colour at the slightly swollen end, the rest of the organ being pinkish-grey and minutely spotted.

Moquin-Tandon is quite misleading in his description of the anatomy of this species, as he states that it does not possess any mucus vesicles ; but in British specimens there are two well-developed bundles, and Herr P. Hesse and A. Schmidt concur in attributing similar organs to continental specimens.

Moquin-Tandon would also seem to be quite unaware of the presence of the conspicuous blind cæcum opening into the vestibule, which is here assumed to be a modified vestige of the dart-sac formerly present.

The ALIMENTARY ORGANS are of the usual character, and present a whitish or yellowish ŒSOPHAGUS, which shows a series of longitudinal white streaks due to the foldings of the inner walls being visible through the investing membrane ; the SALIVARY GLANDS are 6–8 mill. long, slender and whitish, fused together in their upper half, the ducts being about equal in length to the gland itself ; the STOMACH is thin and capacious, of a dusky-grey colour, and elbowed at the further extremity, where it receives the two biliary ducts, which also bind the stomach to the digestive gland ; the INTESTINAL CANAL is of the usual triodromous character, and of a dull green, usually paler than the ordinarily dark greenish-sepia of the liver; on leaving the stomach the first intestinal tract takes a downward course and is fixed to the integument, beneath the kidney, it then returns beneath the head of the kidney towards the stomach, before reaching which organ it again flexes and passes through the liver and gradually narrows to the anal opening.

The JAW or mandible is only slightly crescentic in shape, and quite narrow, with bluntly-rounded ends, of a deep brown colour, especially at the thickened cutting-edge, becoming of an amber tint towards the thinner upper margin, and bears on its anterior surface eighteen or more somewhat irregularly distributed flat ribs, which are narrowest and most crowded in the centre and widest towards the extremities, where they are somewhat convergent in an upward direction ; the lower or cutting margin is feebly denticulate or undulate by the projection of the flattened ribs, and the centre shows a feebly indicated, blunt, median rostrum.

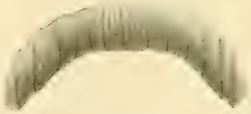


FIG. 117.—Jaw of *Theba cantiana* Mont. (from a photograph by Mr. W. Bagshaw of a preparation by the late Mr. J. W. Neville).

The RADULA is oblong in shape, about 4½ mill. long and 2 mill. broad, and composed on the average of about 135 curved transverse rows of teeth, each row containing about 83 teeth, constituted by a median row of tricuspidate teeth, characterized by a long and powerful mesocone, whose cutting-point extends beyond

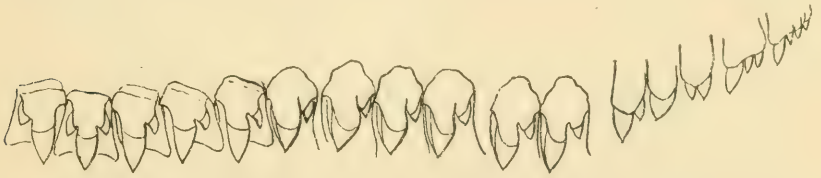


FIG. 118.—Representative teeth from half a transverse row of the radula of *Theba cantiana* (Mont.), photographed by Mr. W. Bagshaw from a preparation by the late Mr. J. W. Neville (highly magnified).

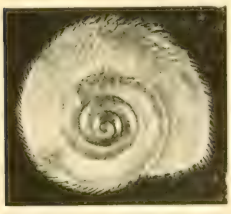
the basal-plate, and with a fairly developed ectocone on each side. The admedians or laterals are about fifteen in number, bicuspidate in character, possessing a strong and stout mesocone, and an ectocone which, as is usual, tends to become more developed as the teeth recede from the centre. The marginals are about

twenty-six in number, and somewhat unstable and irregular in general form and in the number and arrangement of the pectinations.

The formula of a specimen from Walmer, Kent, collected by Mr. W. Whitwell in 1887, and photographed by Mr. W. Bagshaw, from a preparation by the late Mr. J. W. Neville, is

$$\frac{2}{2}\frac{6}{4} + \frac{1}{2}\frac{5}{} + \frac{1}{3} + \frac{1}{2}\frac{5}{} + \frac{2}{2}\frac{6}{4} \times 135 = 11{,}205 \text{ teeth.}$$

Reproduction and Development.—*Theba cantiana* has been noted in congress in most of the months from May to September, the seminal element being transferred by means of a spermatophore, which is closely



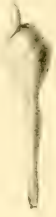


Fig. 119. Fig. 120. Fig. 121. Fig. 122.

Fig. 119.—Young shell of *Theba cantiana*, showing its hispid character, Collingham, Mr. G. Fysher (from a magnified photograph by Mr. W. Bagshaw).

Fig. 120.—Spermatheca of *Theba cantiana* of normal aspect (greatly enlarged).

Fig. 121.—Spermatheca as distorted by the contained rigid capreolus (greatly enlarged).

Fig. 122.—Spermatophore removed from the spermatheca after conjugation (greatly enlarged).

serrate along one side, and whose presence in the spermatheca of the partner snail is shown by the curious twisted appearance it assumes, caused by the rigid, corkscrew-shaped spermatophore, but no further details have been placed on record, though it is probable that the

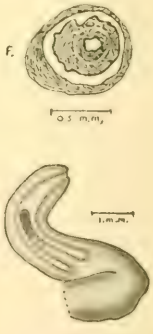


Fig. 123. Fig. 124. Fig. 125. Fig. 126.

The Appendix, degenerate Dart-sac or cœcal excitatory organ of *Theba cantiana*, showing its quiescent form, and some of the changes occurring during sexual activity, greatly enlarged (slightly modified after Prof. Boycott).

Fig. 123.—Cœcal diverticulum, or appendix, in its normal aspect when quiescent; with enlarged transverse sections, showing the lumen.

Fig. 124.—Cœcum during or after conjugation and during the process of its withdrawal after eversion; and Fig. 125, a hypothetical longitudinal section thereof.

Fig. 126.—The contracted cœcum, also showing hypothetically the method of withdrawal in the earlier stages of its reinvagination; with **F**, a transverse section through the central area, in which the dark portions represent the muscular walls of the organ; the inner and outermost spaces indicate its lumen, while the narrow intermediate space is connected and continuous with the body cavity.

elongate vestige of the dart-sac is everted and used as an excitatory organ prior to pairing taking place, an act which may occur even before full growth is attained, the incomplete aperture of the shell being frequently

broken in the act; the probability of this eversion of the elongated cœcum or vestigial dart-sac as an excitatory organ prior to conjugation is shown by the researches of Prof. Boycott, who has demonstrated that during congress this organ still continues wholly or partially invaginated.

The eggs are deposited in clusters in damp spots from May to October; they are sixty to ninety in number, about 1½ mill. in diameter, of an opaline white, and globular in shape, enclosed in a shining and semitransparent envelope, speckled with very minute opaque points of mineral matter, which increase as the envelope dries; the eggs within an hour or two gradually becoming brittle and white. They hatch in about a fortnight; those hatching in the spring and summer seem to hibernate when half to three-quarters grown; the hibernation though varying according to severity or mildness of the season, usually continues from late November to March; at these times the shell is buried in the ground, with the mouth upwards, closed by an epiphragm and level with the surface; after hibernation the immature individuals commence almost at once to enlarge their shells, and many may be seen as early as the end of April with five to six millimetres of new shell growth, and practically full grown except for their peristome, the later hatched individuals maturing later. Many hibernate through a second winter. The young are quite hispid, the hairs being whitish and bent or incurved, as in *Hygromia*, but this investment gradually becomes lost.

Food and Habits.—*Theba cantiana* in this country is found chiefly in hedges and banks, often abundantly on nettles and other plants in wet or damp places; it is also frequently found on the sandhills near the seashore, apparently preferring the stunted grass and herbage of such places to the more rank and luxuriant vegetation of the richer soils, but it is also found in its dwarf form to exist at 6,000 ft. altitude at San Pellegrino, Italy.

During the day it can be frequently seen attached to the twigs and leafage of the vegetation and fully exposed; and when roughly handled has the habit, shared with *H. striolata* and a few other species, of ejecting one or more drops of a clear tasteless fluid, like water.

It is a very active and sensitive species, and on moist days and after rains crawls energetically about, carrying its shell in an inclined position and secreting a clear slime, and travelling 75 millimetres or more per minute on a horizontal surface, or at the rate of a mile in about 14 days and 16 hours, a speed scarcely exceeded by even *Helix aspersa*.

The circulation of the blood is also active, and, as is usual, is much more vigorous in the young than in the adult. In the month of July respiration occurred from two to six times per minute, while the average number of heart pulsations of half-grown animals was 56 per minute, though adults beat only 44 per minute at the same time and place. When extending themselves from the shells the contractions increased to 69 per minute in the immature shells and to 53 in the adults; and when placed on the warm hand the pulsations rose to 106, and in one case to 120, per minute in the young, and to 77 in mature shells.

Mr. George Roberts has actually watched this species feeding upon the growing blades of grass, and Mr. Ashford has noted it similarly occupied on dead grass beneath bramble brushes. The Rev. Ashington Bullen has recorded that at Reigate the species preferred nettles and dock, but that at Dover it haunted bramble bushes in April and May; while Vernon Wollaston states that their carnivorous predilection was shown by the fact

that four specimens of the present species and half-a-dozen individuals of smaller species devoured three dozen coleoptera of half-a-dozen different species, which were confined together in the same receptacle; the natural food, as verified by examination of the stomach contents of several individuals, by Mr. Ashford was shown to be decaying grass and leaves.

Dr. Gain, who has kept numerous specimens in captivity, records that they are shy feeders, and very discriminating or fastidious, as of 95 different kinds of food they left 54 absolutely untouched, and only one, the foliage of the swede (*Brassica rutabaga* DC.) was devoured with avidity; 13 kinds were, however, freely eaten, these were turnip foliage and turnip root (*Brassica rapa* Linné), radish foliage, pea, scarlet runner bean, apple, *Boletus edulis*, *Agaricus campestris*, sow thistle (*Sonchus oleraceus*), woody nightshade (*Solanum dulcamara*), honeysuckle (*Lonicera periclymenum*), lime tree (*Tilia europæa*), and marsh willowherb (*Epilobium palustre*); the remaining 27 were all more or less distasteful.

Economic Uses.—According to Dr. Brumati, this species is regarded as comestible, and eaten in the district around Montfalcone, Goritz.

Parasites and Enemies.—This species was formerly believed to be almost immune from destruction by birds, but its remains have been found, sometimes numerously around "thrush stones" in Kent, Sussex, Hertfordshire, Suffolk, Lincolnshire, and Yorkshire by several reliable observers.

Mice also prey upon it in Northamptonshire, according to the observations of Mr. C. E. Wright.

The glow-worm (*Lampyris noctiluca*) is also recorded by Mr. W. J. Lucas as noticed devouring this species at Oxshott, Surrey.

Protective Resemblance.—Mr. H. Crowther has described and commented upon the protection accorded to this species by its general resemblance to the fungus-infested leaves of the coltsfoot (*Tussilago farfara*), stating that the brown blotched, grey shell has a remarkable similarity to the autumnal patches of the invading fungoid growths on the pale green fading leaves.

Geological Distribution.—*T. cantiana* has not as yet been reported from any deposit older than the Pleistocene, and although Mr. B. B. Woodward has published his opinion that this species is in all probability a post-Roman introduction to this country, and does not occur in any of our British deposits, even in those of most recent date, such views are now demonstrated to be unsound.

It is on record from the gravels of Barnwell and Grantchester, near Cambridge, but Mrs. McKenny Hughes and Mr. J. R. le B. Tomlin after careful investigation have affirmed that the record is erroneous and should be attributed to *Eulota fruticum*.

Pleistocene.—In France, *H. gallo-provincialis* is recorded by M. Locard from the Upper Pleistocene deposits of the valley of the Somme, as well as from the osseous breccias of Corsica.

In Italy, Dr. Pantanelli recorded "*Helix cantiana*" in the "Post Pliocene Travertin," at Colle, near Siena, Tuscany.

In Algeria, a possible form of this species, described as *Helix subcantiana*, is mentioned by Bourguignat as common in the Pleistocene calcareous deposits at the Cap de Garde, near Bône. It is said to be very similar in form, character, and aspect to *Theba cantiana*, but to differ in its much wider umbilicus.

Holocene.—In Dorset, it is recorded from the tufaceous deposit at Blashenwell, Isle of Purbeck, by Mr. J. C. Mansel-Pleydell.

In Kent, it is recorded from the post-Roman deposits, Buckland. Dover, by the Rev. R. A. Bullen; and from alluvium in Erith Marshes by Mr. B. B. Woodward.

In Surrey, it has been found in the upper two feet of deposit at Horseshoe Quarry, Reigate, by the Rev. R. A. Bullen and Mr. L. E. Adams.

In Essex, it was found in shell-marl at Felstead, by Mr. J. French; and also recorded from sand and shell-marl in the excavations for the reservoirs of the East London Waterworks, Walthamstow, by Messrs. Kennard and Woodward.

In Herts., it was collected from the subsoil of a tumulus at Highly Hill, Ashwell, by Mr. H. G. Fordham.

In Suffolk, it was recorded by the Geological Survey, from the railway cutting and brickyard west of Sudbury.

In York S.E., it was found by Mr. Mortimer in a "barrow" of Bronze age, at Birdsall Brow, Driffield.

Variation.—Though this species has so small a range of observed variation, it has been split up into a number of varieties and species, most of which differ from the type form in only a very slight degree. These named forms are about fifty in number, and their allocation has been attempted where any really definite character could be detected.

Much confusion and uncertainty, however, exists, not only as to the status but as to the affinities of many of the modifications, some believing certain forms are worthy of specific rank, while others refer them to the present species, or even to *T. cartusiana*, as insignificant varieties.

Though the variations in form are comparatively slight and infrequent, those of colour depend upon the presence, distribution, and intensity of the rufous-brown pigmentation, and of the presence or absence of the pale peripheral zone; these traces of banding, which are probably vestigial and evidences of a former scheme of coloration are explained by the presence of the white supra-peripheral zone, only evident in the rufous-tinted shells, and which probably at one time formed the division between the upper and lower group of bands.

The var. *gaudefroyi*, a native of St. Florent, Corsica, an insular region, practically at the extreme limit of the specific southern range, retains, according to the available description, the hispid periostracum in adult life, a peculiarity which may be explained by the Corsican form being an earlier or more primitive form of the species, which also probably still inhabits more umbrageous surroundings than their continental relatives.

The hispid epidermis in the more evolutionary active countries is now entirely restricted to the juvenile stage, and becomes totally lost before maturity. This change is probably due to the adoption of a more open and exposed environment gradually diminishing the formerly existent epidermal outgrowths, and may be reminiscent of the remote period, when the country was more densely afforested than is now the case.

In the Mediterranean region the general aspect of the shells as compared with North European specimens is to present a glossier and more finely striate surface, usually of a white or whitish colour with a stronger labial rib.

The north European area of distribution, which includes England, North France, Holland, Belgium, and North Germany, produces a ruder and stronger race, which seems at the present day almost or completely severed from geographical continuity with the whiter and smoother Southern or Mediterranean group.

VARIATIONS OF FORM OF SHELL.

Var. **pyramidata** Colb., Bull. Soc. Mal. Belg., 1867, p. lxxxvi. & 1868, pl. ii.

Helix abchaia Mabille, Guide de Natural, 1880.
Helix cantiana var. *elevata* Williams, Conchologist, vol. i., p. 16, 1891.

Shell of a somewhat pyramidal form.

The sub-var. **elevata** is smaller than the type, with the spire distinctly elevated above the body-whorl; suture deep. Diam., 12 mill.; alt., 8·5 mill.

The sub-var. **abchaia** has a conically-elevated spire, body whorl tumid and large, indistinctly angulate, and of a horn colour. Diam., 16 mill.; alt. 9 mill.

Fig. 127.—*H. cantiana* v. *pyramidata* Colbeau (after Colbeau).

ENGLAND.

Kent W.—Sub-var. *elevata*, Sittingbourne, collected by Mr. J. R. Longhurst (Williams, l.c.).

Kent E.—Var. *pyramidata*, Maidstone, collected by Mr. H. Lamb.

Northampton—Var. *pyramidata*, Towcester, 1893, found by Mr. L. E. Adams.

Lincoln N.—Var. *pyramidata*, Bardney, Dec. 1905, J. F. Musham.

York Mid W.—Var. *pyramidata*, Boston Spa, found by Mr. J. Emmet.

CONTINENTAL DISTRIBUTION.

Belgium—Var. *pyramidata*, Ostend, West Flanders (Colbeau, l.c.).

France—Grasse, Alpes Maritimes, 1904, Hugh Watson.

Italy—Sub-var. *abchaia* Mabille is recorded from Bastia, Corsica, by Westerlund.

Var. **da campi** Villa.

Helix da campi Villa, Catal. Sinom. Moll., 1861, p. 7.
Theba cantiana var. *depressa* Taylor in sched.
Helix cantiana v. *campanica* Paulucci, Bull. Soc. Mal. Ital., 1881, vii., p. 87, pl. 2, f. 1.
Helix sobara (Bourg.), Mabille, Bull. Soc. Philom., Paris, 1881.
Helix apuanica Mabille, Bull. Soc. Philom., Paris, 1881.
Helix ardesa (Bourg.), Mabille, Bull. Soc. Philom., Paris, 1881.

The var. **da campi** is a larger, depressed form, usually white in colour.

The sub-var. **campanica** is described as more widely umbilicated, spire more depressed, body whorl widened.

The sub-var. **depressa** is very similar, but of typical colouring.

Fig. 128.—*Helix campanica* Paulucci, slightly reduced (after Paulucci).

The sub-var. **sobara** is depressed, very little swollen, and moderately umbilicated, of a whitish colour, but tinged beneath with yellowish, diam., 19–20 mill. Its depressed spire probably most closely allies it with the var. *da campi*.

The sub-var. **ardesa** is depressed in shape and very slightly swollen, of a whitish colour, tinged with a rosy shade and microscopically striate. Diam. 18; alt., 16 mill.

The sub-var. **apuanica** is depressed and very slightly swollen, of a dull-yellowish horn colour, the last whorl rapidly increasing in size, but not deflected. Diam., 17–18 mill.; alt. 8–9 mill.

Signor Tommasi records that at Castellgoffredo and other places in Lombardy *H. da campi* is often found paired with *H. galloprovincialis*, but prefers moderately moist grassy fields and shady positions. He also transplanted young *H. galloprovincialis* into moist and shady meadows, and after some years found that the shells had become smaller and moderately transparent, and presented the characters of *H. da campi* Villa.

ENGLAND.

Lincoln S.—Sub-var. *depressa*, Boultham, Nov. 1905 ! J. F. Musham.

CONTINENTAL DISTRIBUTION.

France—A mutation of *Helix d'anconæ* with an almost flat spire and the last whorl undeflected is recorded by Comm. Caziot from the spring at Mourailles near Nice, Alpes Maritimes.

Italy—Var. *da campi*, Mantua and shores of Lake Como, Lombardy, and from Verona, Venetia, by Dr. E. von Martens; also from the Parmese Appenines, Emilia, by Strobel.

Sub-vars. *ardesa*, *sobara* and *apuanica* cited from the Apuan Alps by Westerlund.

Sub-var. *campanica* recorded from Monte Cassino, S. Maria di Monte-Leuce, Pontecorvo in Terra di Lavoro, and Defensa del Matese, Abruzzi, by Marchioness Paulucci; also reported from the environs of Rome by Statuti.

Var. **cemenelea** Risso.

Theba cemenelea Risso, Hist. Nat. Eur. Merid., 1826, vol. iv., pp. 75 and 168.
Helix carthusiana Draparnaud, Tabl. Moll., 1801.
Helix galloprovincialis Dupuy, Hist. Moll., 1848, vol. ii., p. 204, pl. ix., f. 5.
Helix anconæ Issel, App. Cat. Moll. Pisa, 1872, p. 63.
Eulota cantiana var. *cemenelea* Paulucci, Matériaux, Mal. Italie, 1878.
Helix oustercæ Mabille, Guide de Natural, 1880.

The name *cemenelea* of Risso must have precedence, being anterior to that of Dupuy's *galloprovincialis* with which it is generally regarded as identical. In any event Dupuy's name is inadmissible, on account of the name having been used by Matheron in 1842 to distinguish a quite different fossil species.

This is the form described by Draparnaud as *Helix carthusiana* and also named by Risso *Theba cemenelea*, a name derived from the locality Cemeleum (now Cimiez) where it was first noticed by him. According to Nevill, it especially frequents the subalpine regions of the Alpes Maritimes.

Prof. von Martens has remarked that this is the subglobose, more inflated form, of finer texture, whitish colour, and partially concealed umbilicus, which is generally distributed along the shores of the Tyrrhenian Sea from South France to Southern Italy.

Fig. 129.

Fig. 130.

Fig. 131.

Fig. 129.—*Helix cemenelea* Risso, Alpes Maritimes, slightly reduced (after Caziot).

Fig. 130.—*Helix anconæ* Issel, Alpes Maritimes, slightly reduced (after Caziot).

Fig. 131.—*Helix spallanzani* Stef. = *Helix cemenelea* var. *isseli* Vagli, Tuscany, slightly reduced (after de Stefani).

The var. **cemenelea** is somewhat depressly globose, whitish or yellowish-white in colour, finely striate, and more narrowly umbilicate.

The Corsican *Helix oustercæ* Mabille is apparently slightly different from the var. *cemenelea*, shown chiefly in a scarcely perceptible angulation of the periphery.

The sub-var. **galloprovincialis** is described as more globose than *T. cantiana*, with a more elevated spire and finer striæ and sculpturing, the umbilicus narrower and partially concealed by the columellar lip.

The sub-var. *galloprovincialis* Moq.-Tand. has the body-whorl depressed, the striæ finer and more regular, the umbilicus narrower, and the peristome white interiorly and reddish exteriorly.

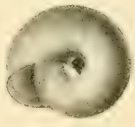


Fig. 132.

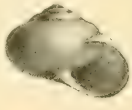


Fig. 133.

Fig. 132.—Basal aspect; and Fig. 133.—Frontal aspect of *Helix galloprovincialis* Dupuy (after Dupuy).

The sub-var. **anconæ** is described as depressly globose, uniformly yellowish-white or whitish, closely and finely striate, and with numerous shallow malleations and close, short, and spiral microscopic lineation, especially on the upper side, very narrowly umbilicate, and also partially covered by the reflection of the basal margin. Diam., 12–14 mill.; alt., 8–11 mill.

The *Helix cemenelea* var. *isseli* Stef. from the Apuan Alps, Tuscany, has been renamed *Helix spallanzani* Stef. because the name *isseli* had already been used for another species of *Helix*.

ENGLAND.

Kent E.—Sub-var. *galloprovincialis* Dupuy, Sarre, Isle of Thanet, April 1883, T. D. A. Cockerell.

CONTINENTAL DISTRIBUTION.

France—Var. *cemenelea* is reported from the Alpes Maritimes by Nevill and Caziot; from the Bouches-du-Rhône and Vaucluse by Coutagne; Basses Alpes by Caziot; Herault by Paladilhe; and from Ajaccio, Bastia, Corte, and St. Florent, Corsica, by Dr. Scharff.

Sub-var. *galloprovincialis* is recorded from Bouches-du-Rhône, Herault, Var, Languedoc, and from Bastia and Bonifacio in Corsica by Moquin-Tandon.

Sub-var. *anconæ* is recorded by Caziot from Vaucluse and the Alpes Maritimes; by Bérenguier from the Var; and by Westerlund from the Island of Elba.

Italy—Var. *cemenelea* is recorded from Liguria at Cimiez, near Nice, by Risso and von Martens; from Avezzano and Carsoli, Abruzzi, and from the Republic of San Marino by Paulucci; by Lessona from numerous localities in Piedmont; by Picaglia from Bologna, Modena, etc., in Emilia; by Statuti from Terracina and Frosinone in Romano; from the Apuan Alps, Mount Argentaro, and the islands, Tuscany, by Paulucci.

Sub-var. *galloprovincialis* is recorded from Nervi near Genoa, Liguria; and also from Tivoli near Rome, July 1888 ! by E. von Martens; from the Valley of the Po, at Turin and elsewhere, Piedmont; the shores of Lake Maggiore, etc., Lombardy; and the province of Emilia, by Strobel.

Sub-var. *anconæ* is recorded from Central Italy; and on the authority of Issel, Villa, and others, from the Island of Sardinia by Paulucci; by Pollonera from Piedmont; by Stefani and others from Bologna, Modena, etc., in Emilia; Mount Verna and other places in Tuscany; and by Westerlund from Liguria.

The *Helix anconæ* var. *marchetti* Stefani (Bull. Soc. Mal. Ital., 1883), and the *Helix anconæ* var. *simplicita* Parreyss are apparently insignificant varieties, which are recorded from Mid-Italy and Italy respectively by Dr. Westerlund.

Austro-Hungary—Recorded from the Trentino, Tyrol.

VARIATIONS OF SUBSTANCE AND PERIOSTRACUM OF SHELL.

Var. **tenuis** Taylor, var. nov.

Shell extremely thin, delicate, and semitransparent; average weight of the type specimens from Kirkby Wiske being 1·86 grains.

This variety is the probable antithesis of the var. *solidula* of Westerlund, but of which the description is not available.

ENGLAND.

Lincoln N.—Very common in one spot at Scunthorpe on blown sand, and the Frodingham iron beds, Aug. 1900, Rev. E. A. Woodruffe-Peacock.

York N.W.—Found at Kirkby Wiske in the Vale of Mowbray, July 31, 1917 ! by Mr. W. D. Roebuck, the specimens in coloring are the sub-var. *rubescens* Moq.

Var. **gaudefroyi** Mabille, Guide de Natural, 1880.

Helix cemenelea var. *gaudefroyi* Westerlund, Faune Palæarct., 1889, p. 80.

Shell depressed, whorls convexly rounded, whitish-horny in colour, beset with fine but deciduous scale-like hairs, periphery indistinctly angulate, and umbilicus almost hidden by the reflected lip.

CONTINENTAL DISTRIBUTION.

Corsica—St. Florent (Westerlund, l.c.).

VARIATIONS IN SIZE OF SHELL.

Var. **major** Taylor, var. nov.

Helix cantianiformis (Bourg.) Ancey, Bull. Soc. Mal. France, 1884.

Shell larger, not less than 20 mill. diam.

The sub-var. **cantianiformis** is described as 20 mill. in diameter and 12½ mill. in altitude. Typically it is rosy-red or violet at the aperture, and brownish basally, and the body-whorl peripherally expanded.

This variety was recorded without name or localities by Mr. Sherriff Tye in 1878 in the Midland Naturalist.

ENGLAND.

Kent E.—Sub-var. *cantianiformis*, Folkestone (West., Moll. Palæarct, 1889, p. 78).

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *cantianiformis*, Ellenserdamm, Oldenburg (Westerlund, l.c.).

Belgium—Specimens of large size recorded from Blankenberghe, West Flanders, by M. le Hon.

France—Var. *major*, 22 mill. in diameter, recorded by Gourdon, from Bramevaque, Hautes Pyrénées.

Sub-var. *cantianiformis*, Boulogne-sur-Mer, Pas-de-Calais (Westerlund, l.c.).

Italy—Specimens 21 mill. in diameter recorded from Vagli, Tambura and Pania, Tuscany, by Stefani; and from Spoleto, Umbria, by Pantanelli.

Var. **minor** Moquin-Tandon.

Helix (*Zenobia*) *cantiana* v. *minor* Moq., Hist. Moll. Fr., 1855, ii., p. 202, pl. xiv., f. 13.
Helix cantiana var. *minor* Westerlund, Moll. Extramar., 1878, p. 58.
Helix d'anconæ var. *minor* Nevill, Proc. Zool. Soc., 1880.
Helix anconæ var. *minor* Westerlund, Moll. Palæarct., 1889, p. 79.
Helix cemenelea var. *minor* Westerlund, Moll. Palæarct., 1889, p. 79.
Helix cemenelea var. *minor* Caziot, Moll. Monaco, 1910, p. 86.
Helix carfanensis var. *minor* Stef., Bull. Soc. Mal. Ital., 1883.
Helix cantiana var. *nana* Fenn, Nature Notes, 1890.

The var. **minor** Moq.-Tand., s.s., is described as resembling the var. *galloprovincialis* Dupuy, but much smaller in size, and is figured as 12 mill. in diameter and 8 mill. in altitude. The sub-var. *minor* Westl. has a subovate aperture, and is 15 mill. in diameter and 10 mill. in altitude.

Fig. 134.—*Theba cantiana* v. *minor* Moq., Yardley Hastings, slightly enlarged, R. Rogers.

The **H. cemenelea** var. **minor** Westl. is described as 14 mill. in diameter and 10 mill. in altitude. The *H. cemenelea* var. *minor* Caziot has a diameter of 10½ mill. and an altitude of 8½ mill.

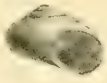


Fig. 135.—*H. galloprovincialis* small var. (after Dupuy).

The **H. anconæ** var. **minor** Westl. is ascribed a diameter of 11 mill. and an altitude of 7½ mill.

The **H. d'anconæ** var. **minor** of Nevill is 11¾ mill. in diameter and 7¾ mill. in altitude, and is regarded by its author as possibly the *Helix delacourti* Mabille, which, however, according to Comm. Caziot, is a somewhat larger though similarly proportioned shell.

ENGLAND.

Somerset N.—Keynsham, Nov. 1887 ! Miss F. M. Hele.

Kent E.—Common, Dover, Aug. 1888 ! Canon J. W. Horsley.

Middlesex—Sub-var. *nana*, Spring Grove, Isleworth.

Bucks.—Ivinghoe, Sept. 1907 ! C. Oldham.

Suffolk E.—Walberswick, 1886 ! G. T. Rope.

Norfolk E.—Longstratton, Aug. 1890, Lionel E. Adams.

Northampton—Yardley-Hastings, Aug. 1885 ! R. Rogers.

Gloucester W.—Horfield and Stapleton, Aug. 1887, Miss F. M. Hele.

York S.E.—Kirkham Abbey, 1891, L. E. Adams. Hunmanby Sands, Filey, Sept. 1909 ! W. E. Brady.

York S.W.—Notton, near Barnsley, July 1907, W. E. Brady.

CONTINENTAL DISTRIBUTION.

France—*H. anconæ* var. *minor* from the littoral zone, Alpes Maritimes (Nevill, Proc. Zool. Soc., 1880). According to Comm. Caziot, this variety is found at Roquebrune, and a still smaller form at Mont Alban, Alpes Maritimes.

Italy—Var. *minor* Moq.-Tand., Valleys of the Tidone, Trebbia, and Secchia, Tuscany (Strobel, Bull. Soc. Mal., 1877, p. 88).

Sub-var. *cemenelea-minor* Strobel is recorded from Modena, Parma, etc., Emilia, by Picaglia.

Sub-var. *carfanensis-minor* is recorded at an elevation of 6,000 feet from San Pellegrino, Emilia.

VARIATIONS IN COLOUR OF SHELL.

Var. **alba** Colbeau, Ann. Soc. Mal. Belg., vol. i., p. 33, 1865.

Helix iadola (Bourg.) in Mace's Excurs. Malac., 1876.
Helix anconæ var. *carfanensis* Stefani, Bull. Soc. Mal. Ital., 1883.
Helix cantiana var. *albida* Taylor, Journ. of Conch., vol. iv., p. 35, 1883.

The var. **alba** is described as shell entirely white.

The sub-var. **carfanensis** is described by Westerlund as wholly opaque or almost hyaline white. Diam., 15 mill. ; alt., 9 mill.

Fig. 136.—*Helix carfanensis* Stef., Vagli, Tuscany, slightly reduced (after de Stefani).

The sub-var. **albida** Taylor is described as shell entirely opaque-white.

The sub-var. **iadola** differs from the sub-var. *anconæ* in its milk-white colour, in the progressive increase of the whorls in size, and less oblique aperture. Diam., 14 mill. ; alt., 10 mill.

ENGLAND AND WALES.

Devon S.—Sparingly in a hedge, Topsham, and near Countess Wear Bridge, E. D. Marquand. Between Exeter and Topsham, Aug. 1892, L. E. Adams.

Somerset N.—Sub-var. *albida*, Bitton near Bath ! and gorge of the Avon, Clifton ! Miss F. M. Hele.

Isle of Wight—Interior of island (Lecomte, Bull. Soc. Mal. Belg., 1869, p. lxiv.).

Hants. S.—Mudeford, 1885 ! Charles Ashford.

Sussex W.—Brighton and Worthing, A. F. Griffiths.

Sussex E.—Lewes, Oct. 1895 ! T. S. Hillman ; and on the east of Brighton ! F. R. Fitzgerald.

Kent W.—St. Mary Cray, Nov. 1887, S. C. Cockerell. Charing and Woolwich, Sept. 1891, L. E. Adams. Ightham, Oct. 1905, F. H. Sikes.

Kent E.—Folkestone, Sept. 1887, J. Madison. Ebbsfleet, Nov. 1887, S. C. Cockerell. Dover, Aug. 1888 ! Rev. Canon Horsley. Sub-var. *albida*, Throwley, Selling, Ospringe, and Faversham, Nov. 1887, Miss E. B. Fairbrass. Maidstone, Aug. 1891, Messrs. Elgar and Lamb. Aylesford and Margate, Oct. 1909, F. H. Sikes.

Surrey—Caterham, 1879 ! Rev. S. Spencer Pearce. Epsom Downs, 1882, B. M. Oakeshott. Warlingham, Dec. 1884 ! T. D. A. Cockerell.

Essex N.—Not uncommon, Chignal St. James, Aug. 1883 ! R. Miller Christy. Near Walton-on-the-Naze, Sept. 1886 ! W. Whitwell. Not uncommon about Colchester, Aug. 1890, Lionel E. Adams.

Herts.—St. Albans, July 1883 ! and in the old moats of the fortifications, Verulam, Sept. 1883 ! J. Hopkinson. Hitchin, Sept. 1885 ! R. D. Darbishire. Sandridge, A. F. Griffiths.

Middlesex—Near Hampstead Heath, May 1889, J. W. Williams.

Berks.—Sub-var. *albida*, Reading, May 1885 ! C. G. Barrett.

Bucks.—Olney, March 1893, L. E. Adams. Ivinghoe, Sept. 1907 ! C. Oldham. Amersham, March 1905, F. H. Sikes.

Oxford—Watlington, 1853, Rev. Canon A. M. Norman.

Suffolk E.—Sub-var. *albida*, River Alde, Snape ! G. T. Rope. Felixstowe, Dec. 1904 ! F. H. Sikes.

Suffolk W.—Chelsworth, G. T. Rope. Sudbury, Sept. 1905, E. Ransom.

Norfolk E.—Long Stratton, Aug. 1890, Lionel E. Adams.

Cambridge—Cambridge, A. F. Griffiths. Wicken Fen, Dec. 1887 ; and very common on the Gogmagog Hills, Oct. 1887 ! J. R. le B. Tomlin.

Bedford—Dallow lane, Luton, May 1889 ! J. Saunders.

Huntingdon—Sub-var. *albida*, Abbott's Ripton, 1899, Rev. R. A. Bullen.

Northampton—Kingscliffe, 1883 ! C. T. Musson.

Gloucester W.—Horfield and Stapleton, Oct. 1887, Miss F. M. Hele.

Worcester—Evesham, July 1882, J. Madison.

Warwick—Henley-in-Arden, Sept. 1882, J. Madison.

Glamorgan—St. Fagans and Cardiff, March 1887, F. W. Wotton. Killay near Swansea, H. R. Wakefield.

Lincoln S.—Bourn, Aug. 1888 ! H. Wallis Kew ; a specimen from Carlby in Grantham Museum.

Lincoln N.—Cadney near Brigg, Oct. 1896 ! Rev. E. A. Woodruffe-Peacock.

Notts.—Staunton-on-the-Wolds, June 1886 ! C. T. Musson.

York S.E.—Allerthorpe and Hedon, Tom Petch. Dunnington near York, R. Miller Christy. Newsholme, July 1886, J. Beanland. Bridlington, June 1903 ! and Hunmanby near Filey, Sept. 1909 ! W. E. Brady.

York Mid W.—Parlington Park, Aug. 1908 ! W. Harrison Hutton. Boston Spa, July 1880 !

CONTINENTAL DISTRIBUTION.

Belgium—Var. *alba*, West Flanders and Antwerp (Colbeau, op. cit., p. 39). Zealand, on the banks of the Selzaete (Van den Broeck, Bull. Mal. Soc. Belg., vol. vi., p. xliv.).

France—Sub-var. *iadola* is recorded from the Abbey of St. Pons, Nice, and from Santa Clara, near Saorge, Alpes Maritimes, by Comm. Caziot.

Italy—Sub-var. *carfanensis*, San Pellegrino, Apuan Alps, Emilia, at about 6,000 feet altitude, and from the Appenines of Tuscany, by L. Picaglia and Stefani.

Var. **rubella** Risso.

Theba rubella Risso, Hist. Nat. Eur. Merid., 1826, vol. iv., p. 75.
Theba charpentieri Risso, Hist. Nat. Eur. Merid., 1826, vol. iv., p. 76.
Helix (*Theba*) *cantiana* var. *rubescens* Moquin-Tandon, Hist. Moll., 1855, p. 202.
Helix cantiana var. *semirufa* Colbeau, Mal. Belg., 1859, p. 8.
Helix riparia Blanc in sched., Westerlund, Moll. Palæarct., 1889, p. 80.
Helix putotiana Caziot, Moll. Monaco, 1910, p. 89, pl. 4, f. 6.
Helix cantiana var. *carnea* Pfeiffer, Monog. Helic. Viv., 1883, vol. iii., p. 118.
Helix rubella var. *faliconensis* Caziot, Moll. Monaco, 1910, p. 87, pl. iv., f. 5.

The var. **rubella** is somewhat reddish in colour, paling towards the apex.

The sub-var. **rubescens** resembles the sub-var. *galloprovincialis*, but has the last whorl reddish.

The sub-var. **semirufa** has the last whorl reddish.

The sub-var. **charpentieri** is described as a dirty-white or horny cinereous variety of *Theba rubella*.

The sub-var. **faliconensis** differs from var. *rubella* in its less convex and almost subcarinate body-whorl and slightly conoid spire.

The sub-var. **putotiana** (the *Helix putotiana* and *Helix putoni* of Caziot, and not *Helix putonii* or *putotiana* ascribed to Clessin, which is probably a *Hygromia*), is depressly globose, of a pale reddish-horn colour, with a very oblique aperture. Diam. 13 mill. ; alt. 8 mill.

The sub-var. **riparia** is globose, reddish horny-yellow, the last whorl entirely reddish, with whitish suture. Diam., 20–22 mill. ; alt., 14–16 mill.

The Italian author, Dr. Picaglia, unites the var. *da campi* with the var. *rubella*.

Though the allocation of *T. rubella* and *T. charpentieri* to the present species is probably correct, that course is not universally approved by scientists, some preferring to give them specific rank, while others include them as forms of *T. cartusiana*.

ENGLAND AND WALES.

Somerset N.—Bitton near Bath, June 1877 ! Miss Hele.

Hants S.—Near Cosham, Aug. 1905, F. H. Sikes. Horndean, on the chalk, Sept. 1883 ! J. Madison. Mudeford, 1885 ! C. Ashford.

Isle of Wight—Brading, 1888 ! T. F. Burrows. Sub-var. *charpentieri*, Sandown ! J. W. Wood.

Sussex E.—Near Lewes, J. H. A. Jenner. Ore near Hastings, A. J. Alletsee. Guestling, E. W. Swanton.

Kent E.—Throwley near Faversham, July 1885 ! Miss Fairbrass. Near Dover, Aug. 1888 ! Rev. J. W. Horsley. Sub-var. *semirufa*, Folkestone, Mrs. Fitzgerald.

Surrey—Grayswood, E. W. Swanton. Haslemere, C. Pannell.

Herts.—Hitchin, Aug. 1883 ! Hugh Richardson. Otterspool Wood, Watford, Aug. 1883 ! John Hopkinson. Hertford, Aug. 1889 ! A. G. Stubbs.

Essex N.—Walton-on-the-Naze, Sept. 1886 ! W. Whitwell. Colchester, Aug. 1890 ! Lionel E. Adams. Near Sudbury, Sept. 1905, E. Ransom.

Cambridge—Gog-Magog Hills, Cambridge, Oct. 1887 ! J. R. le B. Tomlin.

Suffolk E.—Banks of River Alde, Snape, Aug. 1905, G. T. Rope.

Worcester—Evesham, Oct. 1883 ! J. Madison.

Lincoln N.—Common at Scunthorpe, July 1890, Rev. E. A. Woodruffe-Peacock. Bardney, Dec. 1905, J. F. Musham.

York S.E.—Newsholme near Wressle, George Roberts. Springwell lane near Edlington, Oct. 1891 ! W. Denison Roebuck.

York N.E.—Hunmanby sands near Filey, Sept. 1909 ! W. E. Brady.

York N.W.—Studley near Ripon, 1884 ! J. Ingleby.

York Mid W.—Collingham, July 1915 ! G. Fysher.

Durham—Bellingham, 1884, Baker Hudson.

CONTINENTAL DISTRIBUTION.

France—Recorded for South France by Dr. Westerlund ; by Locard from the Rhône valley near Lyons ; and by Comm. Caziot from between Fontan and the frontier, Alpes Maritimes.

Sub-var. *charpentieri*, recorded from the Alpes-Maritimes by Bourguignat.

Sub-var. *faliconensis* is recorded from the north-west of the village of Falicon, Alpes Maritimes.

Sub-var. *putotiana* is recorded from Lyons and the Alpes Maritimes by Caziot.

Holland—Sub-var. *rubescens* Moq., very common by the Selzaete, Zealand; also in weedy ditches at Canisvliet near Westdorp; and commonly at Sluys-Kill.

Belgium—Sub-var. *semirufa*, Antwerp (Colbeau, l.c.).

Italy—Near Nice, Liguria; also at Siena, Tuscany; and Salerno, Campania, Dr. E. von Martens. It is also recorded from near Pergola in the Marches; from Umbria at Avellana, from the Abruzzi at Monte-Corvo, and Santa-Maria-di-Monte-Lence, Terra-di-Lavoro, by the Marchioness Paulucci; by Statuti as not rare at Monticelli and Terracina in Romana; from Bologna and Reggio, Emilia, by Picaglia; and by Stabile and others for Piedmont.

Sub-var. *ardesa* is recorded from the Apuan Alps by Westerlund.

Sub-var. *riparia*, San Germano, Campania (Westerlund, l.c.).

Asia Minor—Sub-var. *carnea* Pfr. = *Helix transmutata* Parreyss, Asia Minor (L. Pfeiffer, l.c.).

Var. **albocincta** Cockerell.

Helix orsinii Tiberi, Bull. Soc. Mal. Ital., 1869, p. 66.
Helix Euomphalia orsinii Picaglia, Bull. Soc. Mal. Ital., 1893, p. 14.
Helix cantiana var. *röddingensis* Schlesch, Ann. Soc. Mal. Belg., 1907, p. 116.

Shell with a white peripheral zone.

This is probably an atavic or palæogenic form, which occurs sporadically and may be expected to occur most plentifully towards the limits of its range or in the less desirable and isolated localities.

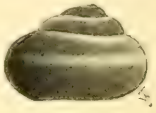


Fig. 137.—*T. cantiana* var. *albocincta* Ckll., Osgodby, Yorks., Mr. W. Nelson.

The sub-var. **orsinii** is fulvous, with a peripheral and also a sutural whitish zone, though other characters are involved in the description, which would include the shell in other categories. Diam., 15–20 mill.; alt., 8½–11½ mill.

The sub-var. **röddingensis** is described as white, with reddish mouth, usually with a peripheral whitish zone extending over more than half of the last whorl.

ENGLAND.

Wilts. S.—Shalbourne, June 1915 ! C. P. Hurst.

Surrey—Ewell, June 1904, T. D. A. Cockerell. Chalk-pit, Leatherhead, G. D. H. Carpenter. Tooting Common, April 1895, C. S. Coles.

Bucks.—Ivinghoe, Sept. 1907 ! C. Oldham.

Northampton—Yardley-Hastings, Aug. 1885 ! R. Rogers.

Lincoln N.—Bardney, Dec. 1905 ! J. F. Musham.

York S.E.—Lund near Osgodby, June 1890 ! W. Nelson.

CONTINENTAL DISTRIBUTION.

Germany—Sub-var. *röddingensis*, Rödding, Schleswig, with type (Schlesch, l.c.).

France—M. Poiret records this form from the Somme; and Lieut. Cribb in Sept. 1916 found this variety in the vicinity of the lagoon Calais, Pas-de-Calais.

Italy—Sub-var. *orsinii* is recorded from the Ascoli-Piceno, Abruzzi, by Mascarini; by Statuti from Sezze, Romana; and from Modena, etc., Emilia, by Picaglia.

MONSTROSITY.

Monstr. **sinistrorsum** Taylor, Journ. of Conch., Jan. 1909, vol. vi., p. 33.

Shell reversed or sinistrally coiled.

ENGLAND.

Wilts.—Found in Wiltshire by Mr. Rippon of Norwood, and presented to me by Miss F. M. Hele. Rev. Canon Horsley also possesses a similar specimen from the same county, received from Mr. S. C. Cockerell, and probably the specimen which Mr. Rippon had kept in his own collection.

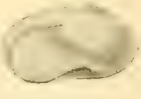


Fig. 138.—*T. cantiana* monst. *sinistrorsum*.

Dorset—Mr. G. K. Gude also possesses a specimen obtained in 1895 through a dealer and labelled Dorset.

CONTINENTAL DISTRIBUTION.

Belgium—M. Nyst has found at Antwerp a sinistral shell of this species (Colbeau, Ann. Mal. Belg., 1865, vol. i., p. 39).

Geographical Distribution.— *Theba cantiana* is apparently quite unknown in Scotland, Ireland, and on the western coast of England, as a result of natural diffusion.

In England its range is exceedingly compact, and embraces every county and vice-county on the eastern and southern coasts from South Northumberland to South Devon, also occupying the neighbouring inland counties, without a single detached outlier throughout its whole range.

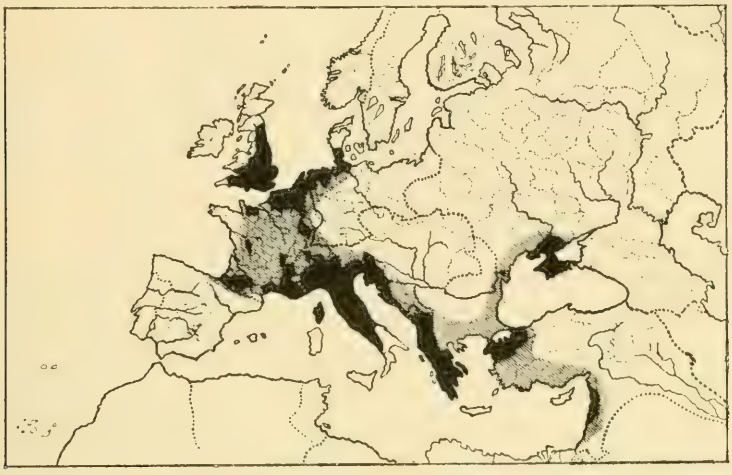


FIG. 139.—Geographical Distribution of *Theba cantiana* (Mont.).

Probable Range Recorded Distribution

Although many attempts have been made with varying success to establish this species in localities where it was not previously known to exist, both within and beyond its known range, its natural distribution has not been very materially interfered with in England.

The attempts to found local colonies by Prof. Boycott in Herefordshire, and by Mr. J. C. Blackshaw near Wolverhampton, would seem to have been more or less successful, while many others, like Mr. Swanton's effort to establish a colony in Somerset, were failures.

It was also introduced into Cumberland, where it was not previously known to exist, by Capt. Farrer, in Aug. 1894, who liberated a number of specimens near Bassenthwaite, which largely increased in numbers the following year and seemed likely to spread.

Its presence along the banks of the Tees and Tyne and elsewhere in Northumberland and Durham has been very generally attributed to its inadvertent introduction with ballast by the "colliers" trading from the ports on those rivers, but no evidence has been adduced, beyond the shells being found plentifully on the ballast-hills of the river-banks.

In Wales it is known from Glamorganshire, where it is locally common.

In Scotland this species is naturally quite unknown, but specimens from England were introduced in 1888 into his garden at Brora, East Sutherland, by Mr. W. Baillie, which have apparently prospered, as in 1895 Mr. Baillie reported that owing to their increasing abundance he had been compelled to remove hundreds of specimens to other places.

In Ireland it was recorded in 1819 by Turton in his Conchological Dictionary as found in "woods and hedges, especially in . . . . Cork": but no confirmation of this statement has been made.

In Sept. 1901, however, Mr. R. A. Phillips, of Ashburton, Cork, placed nineteen full grown *T. cantiana* from Knowle, near Bristol, on a grassy bank by Tivoli Railway Station, near Cork, which now appear to have established themselves there, as Mr. Phillips reported in 1911 that adults and young were quite numerous.

Dr. Turton in his Catalogue of Irish Shells also states that *T. cantiana* was found in "hedges and box-borders about Dublin"; and in 1889 I received from Colonel Dawson some undoubted specimens of *T. cantiana* said to have been collected by his son in a particular spot in Stillorgan Park; but Dr. Scharff and others have assiduously and closely investigated the precise locality indicated by Colonel Dawson, as well as the park generally, without finding a trace of the species, and believe that this reported occurrence must be due to some error.

On the Continent its distribution as far as at present reliably ascertained is more erratic, but its recorded range is somewhat unreliable, owing to the true limits of this species being as yet not authoritatively defined. The *Helix carthusiana* Drap. is usually regarded as synonymic with or a variety of the present species, but others regard it as merely a larger form of *Theba cartusiana*, or as a distinct species to which various names have been applied; but no evidence has been adduced of any differences in internal structure in justification of its separation from *T. cantiana*, though Moquin-Tandon's figure of the internal organs must not be overlooked, although its correctness has never been confirmed.

GERMANY.

Oldenburg—Found along the north-west coast of Germany, between the River Elbe and the River Ems, especially about Eckwarden, Seefeld, and Ellenserdamm in the Bay of Jahde. It is also recorded from the banks of the Lower Weser by Kohlmann.

Holstein—Recorded from the neighbourhood of Hamburg by Prof. Weldon.

Schleswig—Sub-var. *röddingensis* recorded by Schlesch from Rödding.

NETHERLANDS.

Belgium—Only authoritatively recorded from West Flanders at Bruges, Ostend, Nieuport, Heyst, and Blankenberghe.

East Flanders: A dead shell only has as yet been found in the Polders, Assenede.

Antwerp: At Malines, Santvliet, Willebroeck, and the banks of the Escaut. Especially fine specimens have been found in the area at Antwerp between the gates of Berchem and St. Georges.

Brabant: It is reported from Wechter and from Brussels. M. Colbeau thinks the latter locality erroneous, and states that he endeavoured to introduce the species in Brussels, but that the shells dwindled in size and the colony died out in two or three years time.

Holland—In Zealand it is common by the Selzaete; in the Polders of Canisvliet near Westdorp, and common at Sluys-kill.

South Holland: Reported by M. M. Schepmann.

North Holland: Collected by Mr. F. H. Sikes at Koog on the Island of Texel in Apr. 1913; and also enumerated by M. M. Schepmann as inhabiting the province.

SWITZERLAND.

Vaud—*H. cantiana* var. *rubella* reported from Lausanne by Miss Hele.

FRANCE.

This species is recorded by Moquin-Tandon as inhabiting northern and central France, while Reeve states that it inhabits chiefly the central and southern departments. As *H. cantiana*, *H. carthusiana* Drap., or other of its different names, it has, however, been reported by various observers from Alpes Maritimes, Basses Alpes, Basses Pyrénees, Bouches-du-Rhône, Calvados, Drôme, Gard, Haute Garonne, Hèrault, Languedoc, Isère, Meurthe-et-Moselle, Nord, Pas-de-Calais, Rhône, Somme, Var, Vaucluse, Vienne, Vosges, and the Island of Corsica.

ITALY.

The typical *T. cantiana* is, according to Prof. Pollonera, doubtfully present in Italy or Sicily, but in the various varietal or subspecific forms it is widely distributed and actually

Recorded from numerous localities by many observers in Abruzzi, Campania, Emilia, Liguria, Lombardy, Marches, Piedmont, Tuscany, Umbria, Venetia, and the Island of Sicily.

H. orsini Porro recorded from bushy ground Sezze, Romana, by Statuti; and by Valentini from Macèra della Morte, near the summit of Pizzo-di-Siva, Marches.

AUSTRO-HUNGARY.

Carinthia—*H. carthusiana* Drap. (Nachbl. Deutsch. Mal. Ges., vol. i., p. 58).

Carniola—Reported from Carniola by Clessin, who, however, doubts the record. *H. carthusiana* Drap. is, however, also catalogued from Wippacher Thal., etc., in the same region, by Herr F. J. Schmidt.

Istria—Common in the fields, Monfalcone (Brumati, Catal. Monf., 1838, p. 26).

Goritz—Goritz, Miss F. M. Hele.

Dalmatia—Recorded by Schröckinger-Neudenberg.

BALKAN PENINSULA.

Greece—Var. *messenica* Blanc (Faune Mal. Grèce, 1879, p. 41), which may possibly be a form of this species, is recorded from Kalamata in Messinia by Blanc; from near Athens, from Parnassus in Phocis, from Patras, and from the Ossaspitze in Thessaly, by Dr. O. Böttger; reported by Mr. J. R. le B. Tomlin from Olympia, Delphi, Corinth, Sphacteria, and Ithome; and from the Sporades.

Roumelia—Recorded by Mr. G. K. Gude.

IBERIAN PENINSULA.

Spain—Graells cites *Helix carthusiana* Drap. as common throughout all Spain; and Prof. Hidalgo also lists *H. cantiana* as an inhabitant of the country; but M. Morelet states that its existence is doubtful.

Portugal—Lovell Reeve (British Mollusks, 1863, p. 67), noted *H. cantiana* as Portuguese on the authority of M. Morelet's record of a larger and opal white variety of *Helix carthusianella* found only about Oporto. M. Morelet informed me in 1887 that Reeve was in error in attributing this larger variety to *H. cantiana*, the species being as stated *H. carthusianella*.

RUSSIA.

Taurida—*H. galloprovincialis* var. recorded from Sebastopol by Dr. Kobelt.

ASIA MINOR.

Brussa—Prof. von Martens records *H. cantiana* from Kumkale, collected by Herr Virchow.

Palestine—Dr. Böttger records the var. *langii* from Haiffa.

NEARCTIC REGION.

CANADA.

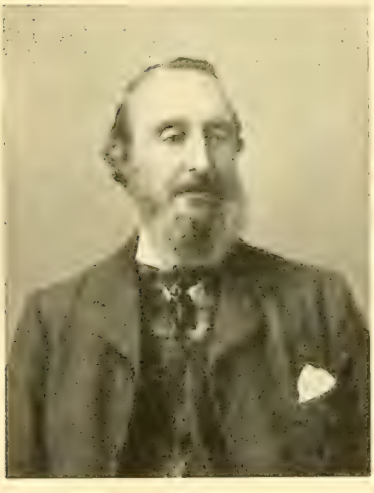
Quebec—Discovered by Mr. F. R. Latchford on the upper slopes of the cliff upon which the citadel of Quebec stands, and recorded in the American Naturalist for Nov. 1885; this occurrence was confirmed by Mr. Hanham, who found it common on the cliff bordering the "Plains of Abraham," and extending to the citadel, but not noticed in the city (Nautilus, Jan. 1897).

Ontario—Reported from Hamilton by Mr. G. K. Gude.

Theba cartusiana (Müller).

1767 *La Chartreuse*, Geoffroy, Traite des Coq., p. 32.

1774 *Helix* **cartusiana** Müller, Verm. Hist., vol. ii., p. 15, no. 214.
1780 — *nitida* Chemn., Conch. Cab., vol. ix., pt. 2, p. 103, pl. 127, ff. 1130–1.
1792 — *arenaria* Olivi, Zool. Adriat., p. 178.
1805 — *carthusianella* Drap., Hist. Moll., p. 101, pl. vi., ff. 31–2.
1820 — *gypsii* Férussac, Journ. Phys., vol. xc., p. 300.
1821 — (*Zenobia*) *bimarginata* Gray, Med. Repos., vol. xv., p. 239.
1833 — *rufilabris* Jeffreys, Linn. Trans., vol. xvi., p. 509.
1833 — *gibbsii* Leach in Brown's Ill. Conch., p. 11, pl. i., f. 18.
1841 — *gilvina* Ziegler ex Lud. Pfeiff. Symb., i., p. 60.
1887 — (*Carthusiana*) *carthusiana* Tryon, Man. Conch., vol. iii., p. 195, pl. 44.
1880 — *sarriensis* Bourg. in Servain, Moll. Esp., p. 52.
1826 Theba *carthusianella* Risso, Hist. Nat. Eur. Mer., vol. iv., p. 75, no. 167.
1833 *Monacha carthusianella* Fitz., Syst. Verz. Oesterr., p. 95.
1837 *Fruticicola carthusianella* Held, Isis, p. 914.
1837 *Bradybæna carthusiana* Beck, Index Moll., p. 19.
1852 *Teba carthusianella* Leach, Syn., p. 69.
1853 *Hygromia carthusiana* Adams, Genera Moll., p. 214.
1912 *Helicella* (*Xerophila*) *carthusiana* Simroth, Bronn's Tier-reichs, vol. iii., p. 590.



Richd Rimmer

HISTORY. — *Theba cartusiana* was first noticed by Geoffroy in 1767 under the name of "*La Chartreuse.*"

The binomial *Helix cartusiana* bestowed by O. F. Müller in 1774 probably on account of its being found in the vicinity of a Carthusian monastery, is the latinized form of Carthusian, and the change to *carthusiana* made by subsequent writers was due to their impression that the letter *h* had been inadvertently omitted by him.

In 1803 Draparnaud mistaking the *H. cantiana* Mont. for *H. cartusiana* applied to the true *cartusiana* the name of *Helix carthusianella.*

In 1814 Mr. Gibbs discovered the species in Britain, and sent specimens to Colonel Montagu, who in mss. applied the name *Helix gibbsii* to them; but it was not published as a British species until 1820, when Baron Férussac recorded it as British in the Journ. de Physique as *Helix gypsii*, an evident misapprehension of *gibbsii.*

With the present species I am happy to associate the late Mr. Richard Rimmer, F.L.S., of Dalawoodie, Dumfries, and am fortunate in being able through the kind interest and sympathy of Miss M. Henriette Rimmer to present the accompanying characteristic portrait.

Mr. Rimmer was an accomplished and enthusiastic conchologist, and the author not only of the popular manual "The Land and Freshwater Shells of the British Isles," but of several interesting special studies of the same subject, which appeared from time to time in the Journal of Conchology and other scientific magazines.

Distribution of *Theba cartusiana* (Müll.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lanes
70 Cumberland
71 Isle of Man

SCOTLAND.

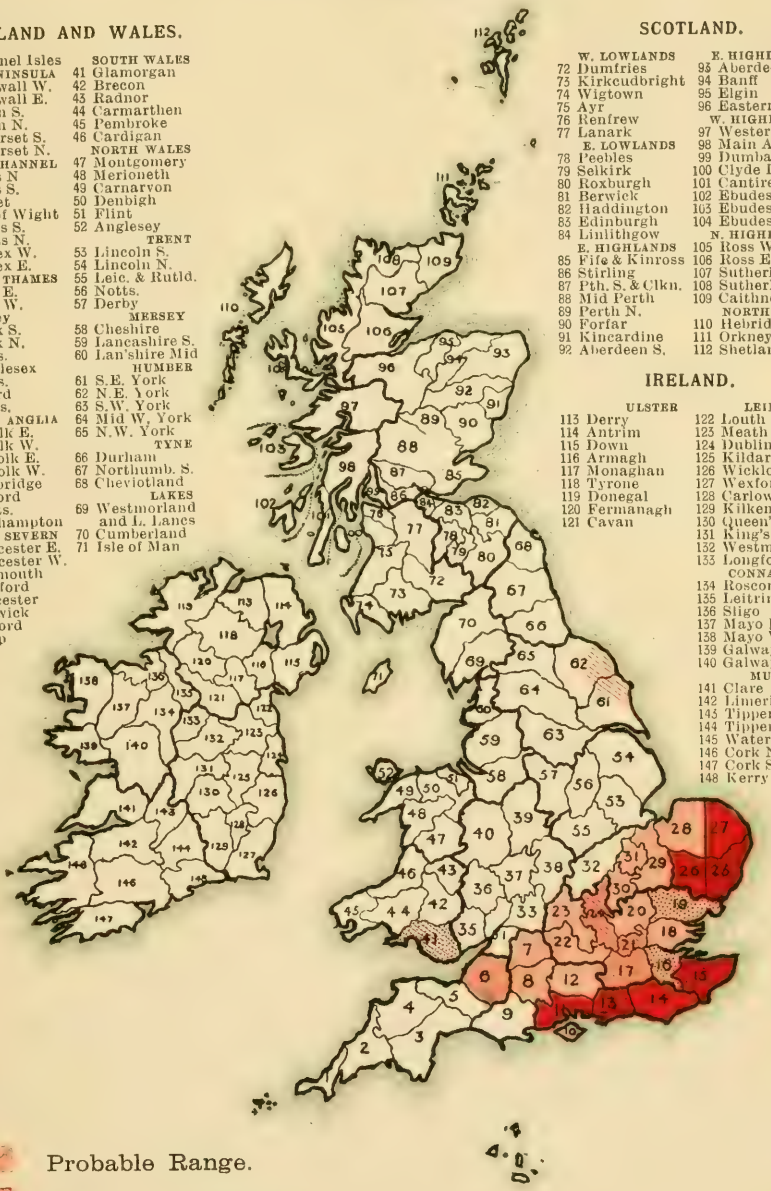
W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford
CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

The long list of synonyms given above on the authority of responsible writers does not exhaust the list, the names *H. gregaria*, *H. pellucidula*, *H. claustralis*, and *H. lucernalis*, all of Ziegler, the *H. innoxia* and *leptomphala* Locard and many others may be added, all indicating some slight local modification in the shell.

Diagnosis.—*Theba cartusiana* is most closely related to *T. cantiana*, but differs in the shell being of smaller size and more opaque when aged; the spire is more depressed, the apertural rib more developed, and the umbilicus much smaller and more contracted.

INTERNALLY, it differs by the much less degenerate stage of the dart-sac and its accessory gland, which in the present species retain the general outward aspect of those organs, while in *T. cantiana* they have dwindled into a long and slender cœcum.

Description.—The ANIMAL has a somewhat slender BODY, obtuse in front, narrowly acuminate and somewhat keeled behind, of a yellowish-grey colour, becoming yellower dorsally, but more translucent and colourless in the rear; the whole upper surface is overspread by somewhat small irregularly-shaped and slightly darker tubercles, many speckled with opaque-white at their summits, which become elongate and sinuate in shape when the animal is fully extended; the DORSAL GROOVES are indistinct and enclose a longitudinal row of narrow and almost linear tubercles; the remainder of the tuberculation on the anterior end of the body is directed obliquely forward and downward. GENITAL GROOVES almost imperceptible, especially on the left side; FACIAL AREA simply tubercular; FOOT-MARGIN or fringe narrow with fine blackish-grey lineolation; FOOT-SOLE yellowish-grey, narrowly margined by a darker grey; OMMATOPHORES long and slender, when fully extended finely tuberculate, and showing the dark retractors along the whole length of their upper surface, and continuing for a space along each side of the dorsum; LOWER TENTACLES unusually long, with their dark retractors well marked and deeply pigmented at their apices, and at their bases a muscular divarication is perceptible through the skin; MANTLE variable in pigmentation, but usually yellowish, marbled and flecked with black, the margin brown or brownish; with the RESPIRATORY ORIFICE darkly and broadly defined, especially above. The EPIPHRAGM is usually thick, solid, and of a dull opaque, cretaceous white.

The shell when containing the animal is on the upper side of a general pale leaden colour, with a brownish tinge on the uppermost whorls; the basal region is usually whitish, tinged faintly with brownish; the peripheral region shows very perceptibly the very elongate, pale yellowish RENAL-ORGAN at the commencement of the penultimate whorl, the upper margin of the organ being almost coincident with the point of junction of the upper lip of the aperture with the shell; the venation of the organ is quite visible through the shell, as are also the main ramifications of the pulmonary vessels on the body whorl near the aperture.

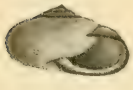


FIG. 141.

FIG. 142.

FIG. 143.

FIG. 144.

FIG. 141.—Frontal aspect, natural size; and FIG. 142.—Upper aspect of *Theba carthusianella*, enlarged (after Draparnaud).

FIG. 143.—Frontal aspect; and FIG. 144.—Upper aspect of *Theba carthusiana*, natural size (after Dupuy).

SHELL globosely depressed, spire only slightly raised, but more convex basally; WHORLS 6, rounded but with a slight supra-peripheral angulation; of an opaque and somewhat opalescent milky-white colour, becoming brownish and more translucent as the aperture is approached, where this colouration is abruptly interrupted by the broad whitish cincture, representing the well-developed and whitish internal submarginal RIB, as seen through the shell substance, the outer apertural margin is brown; the shell surface is smooth and glossy, with a few subobsolete striæ, and also overspread with irregularly reticulate microscopic sculpture, and faint spiral

striation. APERTURE broadly lunate, margins rufous brown and slightly expanded, but more dilated basally, and slightly expanded over the narrowly perforate UMBILICUS.

Average size of British specimens: Diam., 12 mill.; alt., 7 mill. Average weight of British shells: 1·08 grains.

INTERNALLY, the KIDNEY or precordial gland shows as a very elongate and recurved organ, bearing some resemblance to the blade of a scythe; it is of a pale yellowish brown, with its venation quite perceptible through the shell.

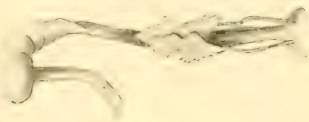


FIG. 145.

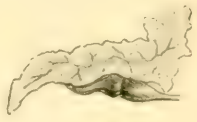


FIG. 146.

FIG. 145.—Proximal portion of the alimentary canal of *T. cartusiana*, shewing the œsophagus, salivary glands, crop, stomach, and the origin of the gut, × 3.

FIG. 146.—Kidney or renal organ, also showing its close association with the heart, × 3.

The REPRODUCTIVE ORGANS are chiefly remarkable for the apparent retention of a DART SAC and ACCESSORY GLAND similar to that seen in certain *Hygromiæ*, but the dart sac shows no signs of the presence of a dart, though in lieu of that weapon the distal portion of the sac has become elongated into a narrowly cylindrical CÆCUM which, probably by eversion, functions as an excitatory organ. The OVOTESTIS is rather compact with a fairly long HERMAPHRODITE DUCT closely convolute and thickened towards its lower end; the ALBUMEN GLAND is elongately linguiform, distinctly concave on its inner face, and of a yellowish colour with sometimes a greenish tinge; the VESICULA SEMINALIS is elongately ovoid, rugose, and of a glandular character; the OVIDUCT is of a transparent grey, distinctly sacculate, and the prostate is granulate, of an opaque creamy-white, broad, and conspicuous;

FIG. 147.

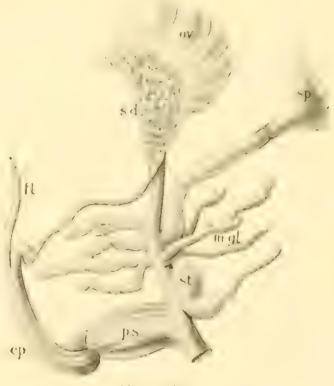


FIG. 148.

FIG. 149.

FIG. 147.—Reproductive organs of *Theba cartusiana* (Müll.), Lewes, × 3, Mr. C. H. Morris.

FIG. 148.—Proximal end of the reproductive organs of *T. cartusiana* more highly magnified.

FIG. 149.—Enlarged portion of distal end of reproductive organs of *T. cartusiana*.

a.g. and *a.gl.* albumen gland; *d.* or *st.* degenerate dart-sac, nascent sarcobelum or excitatory organ; *ep.* epiphallus; *fl.* flagellum; *h.d.* hermaphrodite duct; *m.gl.* mucus-gland; *ot.* ovotestis; *ov.* oviduct; *p.s.* penis-sheath; *s.d.* and *sp.d.* sperm duct; *sp.* spermatheca; *v.d.* vas deferens; *v.s.* vesicula seminalis.

the SPERMATHECA is bluntly triangulate, and of an opaque white, with a fairly long and moderately stout stem; the VAGINA or free oviduct is fairly wide; the VAGINAL MUCUS GLANDS are tinged blue, composed of two groups of simple, bifid, or even trifid cæca, 3–5 mill. long, while immediately beneath them are a degenerating DART-SAC and accessory gland, which except for a digitiform cæcal outgrowth from the distal end of the sac, outwardly present the normal aspect, and are very constant in size and shape, but at present no trace of a dart or gypsobelum is detectable, the function of the lost organ being probably now performed by the vermiform distal outgrowth of the dart-sac, which may function as a sarcobelous

egersidium ; the PENIS-SHEATH is oval in shape, with a peculiar twist at the distal end, which is continued as a moderately long and cylindrical epiphallus, and terminated by a short flagellum ; the VAS DEFERENS is distinctly and strongly dilated at its junction with the distal end of the epiphallus.

Moquin-Tandon's description and figure of these organs differ from those here figured, showing a very long stem to the spermatheca, and only a long vermiform vesicle to represent the degenerate dart-sac, etc., found in English specimens, leading to the belief that by some error the organs of the true *cartusiana* have not been figured or described, but possibly those of *T. cantiana* or some allied form, unless the large South European shell should prove to be a distinct intermediate species.

The figure of the genitalia reproduced by Simroth (Bronn's Tier-reich, iii., f. 198) from Schuberth is also more in accord with that of Moquin-Tandon than with those given herewith, but differ from that author's and the annexed figures in shewing an excessively elongated free oviduct or vagina between the mucus glands and the assumed excitatory organ.

The MANDIBLE or jaw is about 1·5 mill. from side to side, and ·36 mill. from the lower or cutting-edge to the upper margin, of an amber colour, but darker brown towards the cutting-edge, somewhat flatly arcuate, with blunt rounded ends, and bearing about eighteen broad, flat and somewhat divergent ribs, fairly regularly disposed over the whole anterior surface, and slightly denticulating the lower or cutting-margin, but there is no perceptible trace of a median rostration.

FIG. 150.—Jaw of *Theba cartusiana* Müll., Lewes, Mr. C. H. Morris (from a photograph by Mr. W. Bagshaw of a preparation by Rev. E. W. Bowell).

The RADULA is of the usual oblong shape, about 3 mill. in length and 1 mill. in width, and resembles that of *Theba cantiana*, except that the cusps of the marginal teeth are much more elongate in the present species. The organ is constituted by about 140 transverse rows of teeth, each row composed of about 71 teeth, arranged as usual in three series : the median, the admedian or laterals, and the marginals ; the lateral series blending with the marginal teeth. The median series is formed by a single longitudinal row of tricuspid teeth, each bearing a stout mesocone,

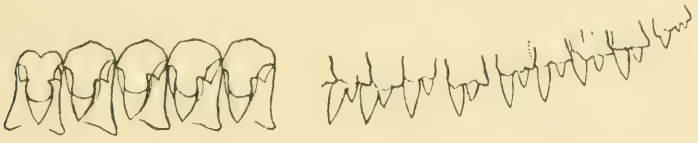


FIG. 151.—Representative teeth from half a transverse row of the radula of *Theba cartusiana* (Müll.) collected at Lewes, Sussex, by Mr. C. H. Morris, and photographed by Mr. W. Bagshaw, from a preparation by Rev. E. W. Bowell (highly magnified).

with a distinct ectocone at each side ; the admedians or laterals are about twelve in number, bicuspid in plan, and larger and stronger than the central row ; the marginals are about twenty-three in number and generally bifid, the cusps being long and comparatively slender, but towards or at the margin of the membrane the ectocone may become bifid.

The formula of an example from Lewes, collected by Mr. C. H. Morris, and photographed by Mr. W. Bagshaw from a preparation by the Rev. E. W. Bowell was

$$\frac{2}{2}\frac{3}{4} + \frac{1}{2}\frac{2}{2} + \frac{1}{3} + \frac{1}{2}\frac{2}{2} + \frac{2}{2}\frac{3}{4} \times 140 = 9{,}940 \text{ teeth.}$$

Reproduction and Development.—Nothing is known of the amours of this species, or any details of the preliminary coquettings leading up to conjugation, but according to Bouchard-Chantereaux and others the eggs are laid in April and May, and specimens were also found in September at Dover by the Rev. Canon Horsley, full of eggs, apparently ripe for exclusion, so that it is probable that egg deposition is continued intermittently through the summer and autumn months.

The eggs are globular and opaline, with a thin, membranous and slightly nacreous envelope; they are about $1\frac{1}{4}$ mill. in diameter, and therefore very large for the size of the animal and almost as large as those of *T. cantiana*,

whose bulk is so strikingly greater; each batch is composed of from 40–80 eggs, which hatch in about a fortnight, and become adult towards the end of their first year. The shell when immature is said to be hispid, thin, and transparent, but gradually thickens, becomes more opaque, and the hairy investment lost as growth proceeds, the aperture being completed when full size is attained.

Habits and Habitat. — Although Moquin-Tandon describes this species as rather slow, the animals studied by me were very bold, active, and fearless, carrying the shell somewhat inclined when crawling, and capable of travelling two inches in one minute, or at the rate of a mile in about twenty-two days.

Though it may occasionally be found on rushes in marshy places, it usually frequents dry and arid, calcareous or sandy ground, clinging to the vegetation or to the grass stems, but at Granville, Manche, it was observed by Mr. F. H. Sikes to have an especial predilection for the dead nettle (*Lamium* sp.). Though chiefly confined to chalky soil and to the vicinity of the sea in this country, it is by no means restricted thereto in Europe, being found quite in the centre of the continent and on a variety of geological formations and under varied physical conditions, flourishing on dry and arid ground, but also prospering on marshy land; and living not only on the plains, but ascending the Pyrenees to a height of 3,000 feet, and in the Emilian Appenines may attain an altitude of nearly 3,600 feet.

During the day it adheres firmly by means of the epiphragm to the stems of plants and grasses, or other suitable objects, frequently fully exposed to the full influence of the hot summer sun, the closure of the aperture of the shell by the epiphragm preventing the evaporation of the natural moisture and consequent desiccation of the animal.

If removed from its position and the epiphragm necessarily broken, the animal promptly emerges from its shell, the hind part of the foot being first extruded with an energetic jerk, quickly followed by the head and body.

The heart pulsations would appear to be more active than in *Ashfordia granulata*, as a specimen in August 1894 showed 56 pulsations per minute at a temperature of 63° Fahr.

It appears to dislike strong winds, and this may account for its preference for the hollows of the downs, where it is somewhat sheltered from its violence, which in exposed places probably dislodges the shell from its fixation to the vegetation, and compels resort to concealment, as during high winds no shells are to be found in exposed positions, but on still days and in sheltered spots the animals remain affixed to the vegetation and fully exposed to the sun's rays.

No direct observations on the food of this species have been published, but it is inferred that the plants frequented are probably fed upon.

During severe weather the animals bury themselves in the sand or earth, and according to the observations of Mr. Hillman apparently resort to similar protection against drought, as few or none can be found at such times.

Enemies.—Retowski has recorded that in the Crimea, Russia, this species is preyed upon by *Phosphuga lævigata*, a coleopteron of the family *Silphidæ*, while *Zonites algirus* devours the animal quite to the apex of the shell.

Dr. Germain has also noticed that the animal is endowed with the power of giving off a very pronounced odour of "mushrooms" when irritated, which may possibly be some protection against certain of its enemies or may have some other signification.

Protective Resemblance.—In August 1894, Mr. Lionel E. Adams found at Sandwich, East Kent, numerous shells of this species clustered upon the withered stems of the hound's tongue (*Cynoglossum officinale*), and so closely resembling in appearance the clusters of burrs or seed capsules of the plant that it was really difficult in the sunlight to distinguish one from the other.

Geological Distribution.—*T. cartusiana* is not known in deposits older than the Pleistocene; its remains in England show a diminishing or retreating species, as it is now scarce and local or quite unknown in districts where its remains demonstrate its former existence.

Pleistocene.—In France, it is recorded from the Upper Pleistocene deposits of the Somme Valley, and from the bone-breccia of Corsica by M. Locard.

It is also recorded by Dr. L. Germain from the loess of the Lyonnais, and of Chartreux, Lyons; also from similar deposits at Chaux and Collonges, Mont d'Or, Rhône, and at Bublane in the Ain.

Holocene.—In Sussex W., it has been found by the Rev. W. A. Shaw in post-Pliocene drift thrown up by the moles from a depth of 2-3 feet on the open land on the north side of the South Downs, West Stoke, near Chichester.

In Sussex E., it has been recorded from the Neolithic hill-wash, Brighton.

In Kent E., it has been recorded from a section disclosed by the cutting of the road under the South Downs, behind Folkestone, and from a deposit at Dover, collected by the Rev. R. A. Bullen.

In Kent W., it has been recorded in an early Neolithic internment at Cuxton; and from Holocene deposits at Otford, Exedown, Greenhithe, and Northfleet.

In Essex N., it has been recorded from the railway cutting and brickyard to the west of Sudbury by the Geological Survey; and from shell marl, Bushey Leys, near Felstead, July 1888 ! by Mr. J. French.

In Suffolk E., it is recorded from the alluvial beds at Butley by Mr. Alfred Bell.

In Glamorgan, two specimens were found during the excavation of a Roman villa at Llantwit-Major (J. Storrie, Trans. Cardiff Nat. Soc., 1888, vol. xx., p. 59).

In Spain, it has been found by the Rev. R. Ashington Bullen in a ten-feet thick deposit near the bridge over the railway, Manresa, Catalonia; and also collected by him from a hill-wash at Porto-Pi, near Palma, Majorca, Balearic Isles.

In Italy, Capt. G. B. Adami has found two specimens in the Lower Post Pliocene peat beds and numerous individuals in the upper layers at Polada, near Lonata, Lombardy; and Signor Valentini has found it in the "Travertin" of the Tronto Valley, Ascoli-Piceno, Marches.

Variation.—The slight local modifications frequently perceptible in the shell have been utilized by authors to split up the present species into a considerable number of species and varieties, many of which, as in *T. cantiana*, have very small value or importance, and which it is difficult and almost impossible to correctly allocate in appropriate groups, owing to the lack of definite characters in the descriptions, and thus leading to perennial disputes upon the true status of the different forms, which can only be definitely settled by a knowledge of their internal structure.

T. cartusiana varies considerably in size, the largest forms being strictly continental in range and usually flatter and paler than the smaller, more globose and deeper coloured British shells, and usually frequent moister and richer feeding grounds than the dwarfer varieties, which are generally believed to be stunted, owing to living upon more arid and less favourable places.

The differences of texture and colour of the shell are exemplified by the specimens from the sandhills of Sandwich, which, as observed by Mr. L. E. Adams, are all thinner and much darker in colour than the individuals living upon the chalk lands.

The traces of banding occasionally more or less clearly perceptible in this species are of the same origin and character, and admit of the same explanation as those of *Theba cantiana* and the *Hygromiæ* generally; they are vestiges of an ancient band system, whose pigment has gradually become diffused and confluent, and is now slowly tending to obliteration. The white somewhat calcified supra-peripheral zone is the division between the upper and lower group of bands, such as is now represented by the space between bands 3 and 4 in the Pentatænia.

VARIATIONS IN FORM OF SHELL.

Var. **conoidea** Branczik.

Helix euscepia (Bourg.), Servain, Mal. Lac. Balaton, 1881, p. 32.
Helix innoxia Bourg. (in Locard), Prodr., 1882, pp. 72 and 316.

SHELL with a somewhat raised spire. I have not seen the original description of this variety or its date of publication, but as it is the most suitable name and probably the oldest, I have adopted it.

The sub-var. **rubricollis** Km. is of compact shape, with elevated spire, and has rib and lip fawn coloured.

FIG. 152.—*H. rubricollis* Km. Travnik, Bosnia, enlarged one-third.

The sub-var. **euscepia** is described as shell conical in shape and very compactly and tightly coiled, usually of a yellowish tint, with the labial rib of a vinous colour. Diam., 14 mill. ; alt., 10 mill.

The sub-var. **innoxia** has a somewhat conoid spire, the last whorl rounded and scarcely deflected, and aperture almost semicircular. Diam. 15–16 mill. ; alt. 9 mill.

CONTINENTAL DISTRIBUTION.

France—All the shells found at Preste, Haute Garonne, in Aug. 1878 by Abbe Dupuy belong the variety which is equally globose above and below.

Sub-var. *innoxia* is recorded from the vicinity of Cannes and Nice, Alpes Maritimes, by Comm. Caziot, and also from Valence, Drôme.

Italy—Sub-var. *euscepia* was discovered in Naples by M. Bourguignat in 1859.

Austro-Hungary—Sub-var. *conoidea*, Branczik, Travnik, Bosnia ! F. H. Sikes.
Sub-var. *euscepia* found on the shores of Lac Balaton, Hungary (Servain, l.c.).
Sub-var. *rubricollis*, Travnik, Bosnia ! (Staudinger and Bang Haas).

Var. **depressa** Pascal, Moll. Haute Loire, 1873, p. 38.

Helix ventiensis (Bourg.) in Fagot, Moll. Quatern., 1879, p. 4.
Helix carthusiana var. *sarriensis* Martorell y Pena, Apunt. arqueol., 1879, p. 78.
Helix sarriensis Bourguignat in Servain, Moll. Espagne, 1880, p. 52.
Helix cantiana var. *almonis* Statuti, Bull. Soc. Mal. Ital., 1882, vol. viii., p. 31.
Helix carthusiana var. *ressmanni* Clessin, Moll. Oester.-Ungarn., 1887, p. 134.
Helix carthusiana var. *depressa* Caziot, Moll. Monaco, 1910, p. 92, pl. iv., f. 14.

The var. **depressa** Pascal is described as of similar size to type form, but very flat above, and with a somewhat prominent keel. The sub-var. *depressa* Caziot is described as resembling the type-form, but much more depressed, and not so high in the spire; the mouth is also more compressed and longer. Diam., 12 mill. ; alt., 6 mill.

FIG. 153.

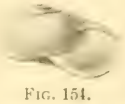


FIG. 154.

FIG. 155.

FIG. 153.—*Helix cartusiana* var. *sarriensis*, slightly reduced (after Caziot).
FIG. 154.—*Helix cartusiana* var. *ressmanni*, slightly reduced (after Clessin).
FIG. 155.—*Helix ventiensis*, slightly reduced (after Caziot).

The sub-var. **ressmanni** is described as shell large, of a yellowish colour, whorls rapidly enlarging, and the last double the breadth of the penultimate, strongly striate, umbilicus more open. Diam., 19 mill. ; alt., 11 mill.

The occurrence of sub-var. *ressmanni* in Carinthia, Carniola, and Friaul has, according to Herr Clessin, given rise to the statements of the occurrence of *T. cantiana* in those regions, the depressed spire, however, infallibly shows its relationship to be with *T. cartusiana*.

The sub-var. **sarriensis** is figured by Comm. Caziot as a depressed form, and may perhaps be suitably placed here. It is said to be identical with the form figured as *H. carthusiana* by Prof. Hidalgo in his Catal. Iconogr. Moll. Espagne, ff. 249–251, and is stated by M. Fagot to be the common Spanish form of the species. A subsidiary form of *H. sarriensis*, which has been distinguished by Caziot as var. *siagnensis*, is of the same size, but differs by its more open umbilical cleft, its less rounded aperture, and less arcuate columella.

The sub-var. **ventiensis** is more depressed, the whorls increasing irregularly in size, aperture depressly semilunar and arched above.

The sub-var. **almonis** is described as large, very depressed, and smooth, of a somewhat opalescent whitish colour, tinged with reddish towards the aperture, which is well rounded. Diam., 20 mill. ; alt., 10 mill.

Sub-var. *almonis* was described by Signor Statuti as a form of *Theba cantiana* Mont., but after a protracted and careful study of authentic specimens received from the author himself, I have removed it from association with that species and placed it with *Theba cartusiana*.

CONTINENTAL DISTRIBUTION.

France—Var. *depressa* Pascal, environs of Choisy-le-Roi, and d'Orly, department of the Seine, and Villeneuve St. George's, etc., Seine-et-Oise (Pascal, l.c.).

Sub-var. *depressa* Caziot is found on the orange trees of the Imperial Park, St. Philippe, near Nice ; also in the fields on the banks of the Paillon, to the west of Fonts Jarrier on the road from Escarène (Caziot, l.c.).

Sub-var. *sarriensis* is recorded from the observatory gardens of Mont Gros, and at the foot of hedges on the right bank of the Paillon, near Nice, Alpes Maritimes, by Comm. Caziot, who also records the sub-var. *sarriensis-siagnensis* Caziot from the alluvium of the Siagne, Alpes Maritimes.

Sub-var. *ventiensis*, very common about Nice, etc., Alpes Maritimes, by Caziot.

Austro-Hungary—Sub-var. *ressmanni* is recorded from Carinthia, Carniola, and near Monfalcone, Goritz, by Clessin.

Italy—Sub-var. *ressmanni* is recorded from Friaul, Venetia, by Clessin.

Sub-var. *almonis* lives on the grassy banks of the ditches among the vineyards in the valley of the historical River Almone near Rome (Statuti, l.c.).

Spain—Sub-var. *sarriensis* has been recorded from Barcelona and other places in Catalonia.

Asia Minor—Var. *depressa* found at Jaffa, Feb. 1904 ! by Mr. F. H. Sikes.

Var. **major** Pascal.

Helix carthusianella var. *magna* Porro, Mal. Comasca, 1838, p. 25.
Helix carthusiana var. *major* Pascal, Moll. Haute Loire, 1873, p. 38.
Helix chartusiana var. *major* Pirona, Moll. Friuli, 1865, p. 7.
Helix carthusiana var. *major* Jenner, Journ. of Conch., 1891, p. 363.
Helix carthusiana var. *major* Westerlund, Fauna Eur. Moll., 1878, fasc. ii., p. 59.
Helix claustralis Ziegler in sched., 1889.

The sub-var. **major** Pascal is 19 mill. diameter and 10 mill. altitude.

The sub-var. *major* of Pirona attains 17 mill. diameter. The sub-var. *major* Jenner is described as 15 mill. diameter. The sub-var. *major* of Westerlund is 18 mill. diameter and 9 mill. altitude.

The var. **magna** Porro is described as 13 mill. diameter.

The sub-var. **claustralis** Zgl. is described by Westerlund as thinner, transparent, and whitish in colour, with an obliquely-rounded mouth, and is figured by Rossmässler as 16½ mill. in diameter.

ENGLAND.

Sussex E.—Sub-var. *major* Jenner occurs about Lewes, J. H. A. Jenner.

Kent E.—Sub-var. *major* Jenner, Lydden near Dover, 1902, G. K. Gude.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *major* Pascal is recorded from St. Denis, department of the Seine, by Pascal ; and sub-var. *major* Moquin from Bastia and Fango, Corsica, by Moquin-Tandon.

Italy—Var. *magna* is described by Porro from examples from Como, Lombardy. Sub-var. *major* Pirona is recorded by its author from Palma, Porto-gruaro, Isola, S. Andrea, etc., in Venetia. Var. *major*, Rome, 1877, Mrs. Fitzgerald.

Sub-var. *claustralis* is ascribed to Italy by Rossmässler.

Austro-Hungary—Specimens, 21 mill. in diameter, from Buda-Pesth, Hungary, are in the Sikes' Collection, now in the British Museum. Sub-var. *claustralis* is ascribed to Dalmatia by Dr. Paetel.

Greece—Sub-var. *claustralis* is recorded by Dr. Westerlund.

Var. **parva** Porro.

Helix carthusianella var. β Draparnaud, Hist. Moll., 1805, p. 101, pl. vii., f. 3, 4.
Helix olivieri Michaud, Compl. Drap., 1831, p. 25 (not of Férussac).
Helix carthusiana var. *b parva* Porro, Mal. Comasca, 1838, p. 25.
Helix (*Zenobia*) *carthusiana* var. *minor* Moq., Hist. Moll., 1855, ii., p. 207, pl. xvi.
Helix chartusiana var. *minor* Pirona, Moll. Friuli, 1865, p. 7.
Helix lamalouensis Reynes, Annales de Malacologie, 1870, vol. i., p. 34.
Helix carthusiana var. *minima* and *minor* Pini, Moll. Esino, 1876, p. 132.
Helix carthusianella mut. *minima* Strobel, Bull. Soc. Mal. Ital., 1877, vol. iii., p. 89.
Helix carthusiana var. *arvensis* Pini, Atti Soc. Ital., 1879, vol. xxi., p. 10.
Helix leptomphala Bourguignat, in Locard, Prodr., 1882. pp. 72 and 316.
Helix stagnina Bourguignat, in Locard, Coq. Fr., 1894, p. 108.
Helix ventiensis var. *minima* Caziot, Moll. Monaco, 1910, p. 96, pl. iv., f. 54.
Helix innoxia var. *minor* Caziot, Moll. Monaco, 1910, p. 72.
Helix sarriensis var. *minor* Caziot, Moll. Monaco, 1910, p. 93, pl. iv., f. 22.

SHELL smaller, spire more risen, mouth rounder, lip or peristome brown, with a milk-white labial rib, and a corresponding whitish transverse zone outside.

H. carthusianella var. β Drap., from Cette, Herault, is described as a smaller and slightly flatter variety with a somewhat rounder and less oval mouth and brown peristome, the internal rib and external marginal band to the aperture milk-white.

FIG. 156.

FIG. 157.

FIG. 158.

FIG. 159.

FIG. 156.—*Helix cartusiana* var. *minor*, frontal aspect, Lewes, Mr. T. S. Hillman, enlarged one-third.

FIG. 157.—Frontal aspect; and FIG. 158.—Basal aspect of *Helix carthusianella* var. β Drap. (after Draparnaud).

FIG. 159.—*Helix arvensis* Pini, Como, Marquis Monterosato, enlarged one-third.

The sub-var. **minor** Moq. is described as smaller, spire more elevated, and aperture rounded. The sub-var. *minor* of Westerlund is 7–8 mill. in diameter and 4–5 mill. altitude, and have mostly reddish lips. The sub-var. *minor* Caziot is figured as 7½ mill. in diameter and 4½ mill. in altitude by Comm. Caziot, who described it as the precise form named *Helix carthusianella* by Risso. The sub-var. *minor* Pirona is 7–9 mill. in diameter.

The sub-var. **parva** Porro s.s., is 10 mill. in diameter and 6 mill. in altitude.

The sub-var. **leptomphala** is smaller and flatter, with the body-whorl slightly developed, and an umbilicus of somewhat ellipsoidal shape. Diam., 7½–8½ mill.; alt., 5–6 mill.

The sub-var. **lamalouensis** Reynes is described as being 9 mill. in diameter.

The sub-var. **stagnina** is smaller and flatter, body-whorl subangulate, aperture more oval. Diam., 9 mill.; alt. 6 mill.

The sub-var. **ventiensis-minima** Caziot is smaller with flatter whorls, shallower sutures, and more elongate aperture. Diam., 7 mill.; alt. 5 mill.

The sub-var. **innoxia-minor** Caz. is described as 10 mill. diam. and 6 mill. alt.

The sub-var. **minima** Strobel is described as 7 mill. in diameter.

The sub-var. **arvensis** is 8 mill. in diameter; its larger form *taurinensis* Poll. (Moll. Piemonte, 1885, p. 24) varies between 9 and 11 mill.

The sub-var. **sarriensis-minor** is described as 8 mill. in diam. and 6 mill. in alt.

The *Helix olivieri* Mich., is probably a variety of the present species, which only differs from the var. *rufilabris* in possessing a white labial rib; it has been allocated very frequently to the var. *rufilabris*, but this is shown to be incorrect by

a study of Michaud's description and his reference to the figure of Draparnaud as representing his species.

It is, according to Dr. Gassies, the *Helix incolata* of Parreyss, which has been regarded as identical with *H. onychina* Rossm., but he confuses this form with var. *rufilabris*.

Inhabits dry places in the maritime districts, frequenting the thistles and *Eryngiums* growing there.

ENGLAND.

Sussex E.—Lewes, Oct. 1899 ! T. S. Hillman.

Kent E.—Chalk hills, Folkestone, Nov. 1899 ! Mrs. Fitzgerald. Dover, Sept. 1913 ! W. E. Brady. Patrixbourne, a colony exclusively of this variety, averaging 7½ mill. in diameter, Lionel E. Adams.

CONTINENTAL DISTRIBUTION.

France—Alpes Maritimes, Aisne, Basses Alpes, Gard, Gironde, Hérault, Morbihan, Seine-et-Oise, and Vendée. Mornex, Upper Savoy ! and Aix-les-Bains, Savoy ! Rev. S. Spencer Pearce. Sub-var. *minor* of Caziot is recorded by Caziot from the left banks of the Var, Alpes Maritimes.

Sub-var. *minima* Caziot, Alpes Maritimes.

Sub-var. *stagnina* is common amongst the pines at the chateau of Palarea near Nice and in other localities in the Alpes Maritimes.

Sub-var. *leptomphala* is common in meadows on the banks of the river Var; also in pine woods at an altitude of near 2,000 feet on Mont Chauvé and other localities in the Alpes Maritimes. It is recorded by Dr. Westerlund from Toulouse, Haute Garonne, and Nantes, Loire Inferièure.

Sub-var. *innoxia-minor* is found at St. Vallier, and in the alluvium of the river Loup, Alpes Maritimes.

Sub-var. *lamalouensis*, Lamalou-lès-Bains, Hérault (Reynes, l.c.).

Sub-v. *sarriensis-minor*, alluvium of river Siagne, Alpes Maritimes (Caziot, l.c.).

Sub-var. *ventienis* is recorded from Nice and other places in the Alpes Maritimes by Comm. Caziot.

Austro-Hungary—Buda-Pesth, Hungary ! R. D. Darbishire. *Helix incolata* Parreyss, Transylvania.

Italy—Many localities in Emilia, Lombardy, and Venetia. A specimen, 6 mill. diameter, from roadside, near railway station, Erba, near Como, Lombardy, Rev. S. Spencer Pearce. Sub-var. *minor* Pirona, Tagliamento, etc., Venetia.

Sub-var. *minima* Strobel is recorded from several localities in Emilia by Strobel.

Sub-var. *arvensis* is recorded from Lombardy at Belgiojosa near Pavia by Pini; and reported from Como by Marquis Monterosato. From Piedmont Prof. Pollonera records it from near Turin, and the subsidiary form *taurinensis* from same province.

Asia Minor—Smyrna, specimens 7½ mill. diam. collected by Fritsch in 1874.

VARIATIONS IN COLOUR OF SHELL.

Var. **lactescens** Picard.

Helix carthusianella var. *b lactescens* Picard, Moll. Somme, 1840, p. 223.
Helix carthusiana var. *alba* Jenner, Journ. of Conch., 1891, vi., p. 363.
Helix carthusiana var. *casta* Monterosato mss.

The var. **lactescens** Picard, is described as SHELL milk-white and transparent, aperture of same colour, with a whiter rib. The sub-var. *lactescens* of Moquin-Tandon is of a transparent milky-white, without band.

The sub-var. **alba** is described as "pure milk-white, mouth and rib white."

The sub-var. **casta** conforms exactly to the description of Picard.

ENGLAND.

Sussex E.—Sub-var. *alba*, this beautiful variety was discovered at Ranscombe Brow, near Lewes, in 1889, by Mr. T. S. Hillman, and Mr. J. H. A. Jenner afterwards found specimens in 1890 in a neighbouring locality.

CONTINENTAL DISTRIBUTION.

Germany—Mentioned by Clessin as occurring, but without citing precise locality.

France—Var. *lactescens* described by Picard from specimens found in the department of the Somme; recorded by Pascal from St. Denis, department of the Seine; by Locard from Lyons in the department of the Rhône, and at Miribel and Belley, department of the Ain; and by Dubrueil from Hèrault.

Italy—Menaggio and Lecco, Lombardy, but not commonly, Sept. 1886, J. R. le B. Tomlin. Bellagio, Lake Como ! Rev. S. Spencer Pearce.

Sub-var. *casta* Monterosato, Como, Lombardy ! Marquis Monterosato.

Portugal—The larger opal-white variety recorded by Morelet from Oporto, and referred by Reeveto *Helix cantiana*, really belongs to this species, as I was assured by M. Morelet himself.

Var. **lutescens** Moquin-Tandon, Hist. Moll. France, 1855, vol. ii., p. 207.

The var. **lutescens** of Moquin-Tandon is described as yellowish.

The var. *lutescens* of Locard is described as shell yellowish, peristome brown interiorly, thin and reflected.

CONTINENTAL DISTRIBUTION.

Germany—Mentioned by Clessin as occurring, but without citing precise locality.

France—L'Isle Adam, Seine, and also on the banks of the Marne, Seine et Marne (Pascal, Moll. Haute Loire, 1873, p. 38). Dr. Grateloup records this form as var. 2 from Dax, Landes ; and Dubrueil from Hèrault.

Italy—A flaxen-coloured form recorded from S. Ciro, near Palermo, and the Madonie, Sicily, by Benoit.

Var. **fuscescens** Pascal, Moll. Haute Loire, 1873, p. 38.

Helix carthusiana var. *littoralis* Stossich.

SHELL entirely brown.

The var. **littoralis** may perhaps be regarded as a somewhat paler form of this variety.

ENGLAND.

Kent E.—A near approach to this variety was found by Mr. W. E. Brady at Seabrook near Hythe, Sept. 1913 !

FIG. 160.—*T. cartusiana* var. *littoralis* Stossich, Monfalcone, Goritz, Austro-Hungary, Marquis Monterosato, enlarged one-third.

CONTINENTAL DISTRIBUTION.

France—L'Isle Adam, Seine (Pascal, l.c.); and Aix-les-Bains, Upper Savoy ! Rev. S. S. Pearce.

Austro-Hungary—Sub-var. *littoralis*, Monfalcone, Goritz (Marq. Monterosato).

Var. **encyæ** Servain.

Helix encyæ Servain, Mal. Lac. Balaton, 1881, p. 31.

The var. **encyæ** is very globosely swollen, of a subcarneous violaceous tint, tending to bluish. Diam., 15 mill. ; alt. 10 mill.

CONTINENTAL DISTRIBUTION.

Austro-Hungary—Banks of Lac Balaton between Füred and the peninsula of Tihany, Hungary.

VARIATION IN COLOUR OF APERTURE.

Var. **rufilabris** Jeffreys, Brit. Conch., 1862, vol. i., p. 193.

Helix rufilabris Jeffreys. Linn. Trans., 1830, vol. xvi., p. 509.
Helix archimedea Benoit, Ill. Test. Estram. Sic., 1859, p. 164.
Helix cartusiana var. *minor* L. Pfr., Monog. Hel. Viv., 1868, vol. v., p. 198.

The var. **rufilabris** Jeffreys is described as shell smaller, with the inside lip and rib of a reddish-brown colour.

The sub-var. *rufilabris* Caziot is small, milk-white in colour, more globose and malleate. The sub-var. *rufilabris* of Pascal is smaller than the type, very thin, with

FIG. 161.

FIG. 162.

FIG. 163.

FIG. 161.—Frontal aspect ; and FIG. 162.—Basal aspect of *H. rufilabris* (after Dupuy).
FIG. 163.—Dorsal aspect of *H. archimedea*, Syracuse, Sicily, Marquis Monterosato, enlarged one-third.

a red apertural rib; and the sub-var. *rufilabris* of Germain is described as a distinct species, differing from *T. cartusiana* by its uniformly smaller size, more globose form, more elevated spire, rounder mouth, and larger body whorl, though less

developed in diameter. The animal is also described as differing from *T. cartusiana* in being black with a whitish line on the neck, and white or yellowish marblings on the mantle, while in *T. cartusiana* the mantle is said to be white with black or more frequently yellow marblings.

The sub-var. **archimedea** is described as possessing a reddish labial rib. Diam., 13 mill. ; alt., 10½ mill.

According to Dumont and Mortillet and others, this is an arid ground variety, differing from *T. cartusiana*, which congregates in moister places, by living in dry stony localities or on ground covered with brushwood ; the deficient moisture and warmth imparting to the animal and shell a deeper tint, retarding the development and rendering the shell more globose, with rounder mouth and more elevated spire.

ENGLAND.

Sussex W.—Common about Littlehampton (Jeffreys, l.c.).

Sussex E.—Lewes, abundant, Oct. 1883 ! T. S. Hillman. Mount Caburn near Lewes, common, Aug. 1883 ! Rev. S. Spencer Pearce. Wilmington near Eastbourne, Sept. 1908, W. E. Brady. Ranscombe near Lewes, J. H. A. Jenner.

Kent E.—Folkestone, 1882 ! Mrs. Fitzgerald.

CONTINENTAL DISTRIBUTION.

France—M. Grateloup ascribes it a distribution over almost all France ; while M. Germain states that it has been reported from almost every department. I have noted records from Ain, Aude, Alpes Maritimes, Basses Alpes, Basses Pyrénées, Calvados, Champagne Meridionale, Drôme, Gers, Hautes Pyrénées, Landes, Morbihan, Orne, Oise, Rhône, Seine, Seine-et-Oise, Savoy, and Upper Savoy, Var, Vaucluse, and Yonne.

Switzerland—Reported from Vevey, Canton Vaud, by Lieut.-Col. Parry ; and by Dumont and Mortillet for Lausanne and Geneva.

Italy—Rare in Piedmont in the alluvium of the River Po near Turin, Prof. Pollonera ; and collected at Menaggio, Lombardy, in Sep. 1886 by J. R. le B. Tomlin.

Sub-var. *archimedea* first found in the ancient Roman Amphitheatre, Syracuse, Sicily ; it is rare in the fields about Palermo and the Madonie (Benoit, op. cit.).

Spain—Var. *rufilabris* recorded from Escalona, etc., Aragon, by Prof. Hidalgo.

Var. **leucoloma** Stabile, Moll. Lugano, 1859, p. 54.

Helix carthusiana var. *albolabiata* Baudon, Moll. Oise, 1862, p. 23.

The var. **leucoloma** is described as smaller, and with an entirely white peristome or lip. The sub-var. *leucoloma* Taylor is small, peristome and rib white.

The sub-var. **albolabiata** has the peristome whitish or perfectly white.

ENGLAND.

Kent E.—Var. *leucoloma*, Beechborough, near Folkestone ! Mrs. Fitzgerald.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *albolabiata*, rare, Balagny, Oise (Baudon, l.c.).

Italy—Var. *leucoloma*, Lugano and Castagnola, Lombardy (Stabile, l.c.) ; and Pini records it as rather rare at Varenne and about Lecco in the same province. Stabile also reports it from the Bormida Valley, and Acqui, Piedmont.

VARIATIONS IN MARKINGS OF SHELL.

Var. **fasciata** Westerlund, Faun. Eur. Moll., Prodr., Fasc., ii.., p. 59, 1878.

Body whorl with a rufous supra-peripheral spiral band, which is continued on the upper whorls and clearly visible about the sutural line.

This variety is an atavic one, and essentially identical with the var. *albocincta* of *T. cantiana*; the rufous band is the original colour of the bands reduced to its smallest visible dimensions, and is placed as usual above the pale zonulation, which formerly separated the upper and lower group of bands.

Fig. 161.— *T. cartusiana* showing traces of four bands, Grande Chartreuse, Rev. S. S. Pearce, enlarged one-third.

Westerlund gives no locality for this variety, but I have a specimen from Syracuse, Sicily, received from the Marquis Monterosato ; and another, rather more sombre in colour, collected at Lewes, Sussex, by Mr. C. H. Morris.

ENGLAND.

Sussex E.—Lewes, associated with the usual form, Oct. 1916 ! C. H. Morris.

CONTINENTAL DISTRIBUTION.

France—The Rev. S. Spencer Pearce has an example collected in 1882 at Grande Chartreuse, Isère, which shows slight but distinct trace of spiral bands at the aperture which may be regarded as occupying approximately the positions of 2345 in the pentatæniate formula.

Italy—Syracuse, Sicily ! Marquis de Monterosato. Rev. S. Spencer Pearce has a shell from Erba, Lombardy ! with a well defined band, but occupying a very limited space at the beginning of the penultimate whorl.

Var. **radiata** Westerlund, Fauna Eur. Moll., Prodr., Fasc., ii., 1878, p. 60.

Helix diurna (Bourg.) Locard, Etud. Var. Malac., 1880, vol. i., pl. iii., ff. 11, 12.

SHELL porcellanous, with numerous translucent radiate markings ; peristome entirely white, with a broad snow-white rib.

The sub-var. **diurna** is described as white, with dark grey flammular markings, of a depressed shape, with an obliquely oblong aperture. Diam., 11¼; alt., 7 mill.

CONTINENTAL DISTRIBUTION.

France—Sub-var. *diurna*, Lyons, Rhône, Dr. Westerlund.

Italy—Viareggio, Tuscany, Marchioness Paulucci.

Var. **bicolor** Pascal, Moll. Haute Loire, 1873, p. 38.

SHELL half horn-colour and half milky-white, the shell of usual size, with a red or white internal apertural rib.

ENGLAND.

Kent E.—Seabrooke, near Hythe, September 1913 ! W. E. Brady.

CONTINENTAL DISTRIBUTION.

France—Fontenay-sous-Bois, Seine-et-Oise (Pascal, l.c.).

MONSTROSITIES.

Monst. **scalare** Taylor, nov. monst.

SHELL with the whorls more or less dislocated.

CONTINENTAL DISTRIBUTION.

France—Millet has recorded a beautifully scalarid shell, found by the lime-kilns of Angers, department of Maine-et-Loire.

Monstr. **sinistrorsum** Jaudouin (Grateloup, Cat. Moll. Fr., 1855, p. 53).

SHELL reversed or sinistrally coiled.

Only as yet recorded from Hungary and France.

CONTINENTAL DISTRIBUTION.

France—Recorded by Grateloup for Bordeaux, Gironde; and by Moquin-Tandon from the Haute Garonne, and Montpellier, Hérault.

Austro-Hungary—Recorded from Buda-Pesth, Hungary, by Julius Hazay.

Geographical Distribution.—*Theba cartusiana* though especially southern and western in its distribution is represented in many european countries, but shows many of the characters of a retreating species, being quite absent from north-central Europe, but is found in England, Denmark, Holland, Belgium, Russia, Austria, France, Greece, European and Asiatic Turkey, Servia, Albania, Bulgaria, Roumelia, Roumania, Italy, Spain, Portugal, Switzerland, Egypt, and Palestine, and from the eastern and western regions of Germany.

In the British Isles it is apparently restricted to a stretch of the South Downs, extending from Hampshire to Kent, and is found sporadically in East Anglia in the living state as well as fossil in the Holocene deposits.

It formerly existed on the East Moors, near Cardiff, believed to have been imported with ballast, but it has also been found in the fossil state

in deposits of Roman age, exposed during the excavations of a Roman villa at Llantwit Major, near Cardiff, by Mr. Storrie.

It has also been reported from the Yorkshire coast by Mr. T. Hagger; and from near Bath, North Somerset, by Mr. Thos. Rogers and Dr. C. W. Viner, who possessed specimens therefrom.

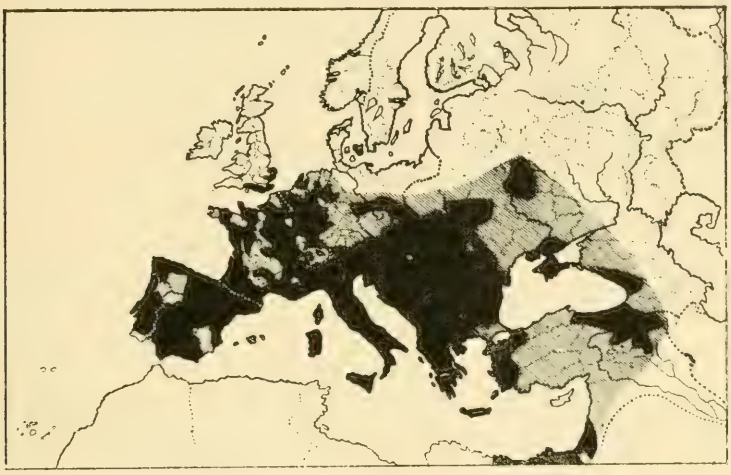


FIG. 165.—Geographical Distribution of *Theba cartusiana* (Müll.).

ENGLAND AND WALES.

Somerset N.—Specimens labelled "Bath" existed in the collections of the late Mr. Thomas Rogers of Manchester, and Dr. C. W. Viner of Bath, and records exist of the occurrence of this species near Bristol.

Hants S.—On rushes in Farlington Marsh, Sept. 1909 ! and on Portsdown Hill, Oct. 1902, H. Beeston.

Sussex W.—In great plenty, but of small size, around Littlehampton (Leach, Synop., 1852, p. 69). The lower part of the northern slope of Amberley Down, T. Godlee. Finden near Worthing, Aug. 1883, A. F. Griffiths. On the sand banks by the River Adur, above Old Shoreham, Aug. 1885, W. Jeffery. Bosham, near the county boundary of Hants, Sept. 1915, Rev. W. A. Shaw.

Sussex E.—Particularly abundant on the chalk downs near the coast, Brighton (Merrifield's Nat. Hist. Brighton, 1860, pp. 158 and 223). Common on the South Downs near Lewes, and about Beachy Head (Harting's Rambles, 1875, p. 81). Plentiful on the downs at Aldfriston, 1881; at Wannock near Eastbourne; and near Glynde, 1881, Rev. S. Spencer Pearce. Blatchington and Seaford, 1860 ! Rev. Canon A. M. Norman. Very abundant on the slopes of Mount Caburn, and on Ranscombe Brow near Lewes, but finest on a railway bank about 1¼ miles from Beddingham, Aug. 1883 ! R. Miller Christy. Plentiful about Lewes, Aug. 1883 ! T. S. Hillman. A fine colony on the downs near East Down, Eastbourne, 1900, A. G. Stubbs. Hastings and Malling Marsh near Lewes, Sept. 1885, E. Collier. Wilmington near Eastbourne, Sept. 1908, W. E. Brady.

Kent E.—Common on the sandhills about Sandwich, and on the chalk hills about Beechborough, Folkestone, 1876, Mrs. Fitzgerald. East Cliff and behind the castle, Dover, Aug. 1875, L. E. Adams. Plentiful near golf-links, Dover, July 1896; on the golf-links, Sandwich, Sept. 1900; the Park, Patrixbourne; and a large colony by the side of the canal, Hythe, Aug. 1909, C. E. Wright. Deal, Mr. Corrie and H. C. Leslie.

Kent W.—A large number of specimens from Sandwich were liberated about Chislehurst, but appear to have gradually died out (T. D. A. Cockerell, Journ. of Conch., 1884, p. 238).

Surrey—Banstead Downs (D. Cooper, Flora Metrop., 1836, p. 122). Kenneth McKean has also recorded in the Transactions of the Croydon Nat. Society that *Theba cartusiana* has been found on Banstead Downs by H. T. Mennel and others.

Middlesex—Recorded in the Flora Metropolitana by D. Cooper for Hampstead Heath.

Bucks.—Recorded from near Hartwell House, Aylesbury, Apr. 1852 by E. J. Lowe.

Suffolk E.—A single dead but fresh specimen in good condition found at Little Glemham by Mr. G. T. Rope in March 1899. Rather plentiful on a chalky hedge-bank with a south-west exposure near Needham Market, Oct. 1902 ! A. Mayfield.

Suffolk W.—A dead shell found at Great Fakenham, Sept. 1908 ! F. H. Sikes ; and another specimen picked up at the same place by Mr. A. Mayfield.

Norfolk E.—A fairly fresh dead shell, Long Stratton, Aug. 1890 ! L. E. Adams.

Glamorgan—A colony formerly lived on East Moors, Cardiff, about 1880, but has since disappeared ; the ground is now built over, F. W. Wotton.

York S.E.—A specimen found at Hunmanby Gap, Filey, Aug. 1887, T. Hagger.

— —

GERMANY.

Appears to be restricted, more or less closely, to the vicinity of the western and eastern frontiers, and has only been reported from Alsace, Baden, Lorraine, Nassau, Rhenish Prussia, Saxony, Silesia, Suabia, and Westphalia.

NETHERLANDS.

Holland—Heer Schepmann reports its discovery in North Holland in 1914.

Belgium—Several localities in West Flanders, and also reported from the Grand Duchy of Luxemburg with a doubtful record from Colonstère in the province of Liége.

FRANCE.

Though reported as found over the whole of France, this statement is not yet supported by actual records of its existence in every department. It has, however, been reported from fifty-eight of the eighty-six departments into which the country has been divided :—From the Agenais, Ain, Aisne, Allier, Alpes Maritimes, Ariége, Ardennes, Aube, Aude, Aveyron, Basses Pyrénées, Bouches-du-Rhône, Basses Alpes, Calvados, Champagne Meridionale, Charente Inférieure, Côtes-du-Nord, Côte d'Or, Drôme, Gard, Gers, Gironde, Haute Garonne, Haute Marne, Hautes Pyrénées, Hérault, Indre-et-Loire, Isère, Jura, Landes, Loire Inférieure, Lozère, Lot, Lot-et-Garonne, Maine-et-Loire, Manche, Meurthe-et-Moselle, Morbihan, Nièvre, Nord, Oise, Orne, Pyrénées Orientales, Rhône, Saône-et-Loire, Sarthe, Savoy and Upper Savoy, Seine, Seine Inférieure, Seine-et-Marne, Seine-et-Oise, Somme, Tarn-et-Garonne, Var, Vaucluse, Vendée, Vienne, Yonne, and the Island of Corsica.

IBERIAN PENINSULA.

Spain—Recorded by Gräells as inhabiting the whole of Spain, and precise records are available from every province except Leon and Murcia ; it has also been detected by Rev. R. A. Bullen in a Holocene deposit at Majorca, Balearic Isles.

The var. *sarriensis* is smaller than the type form, with a rounder and almost oblique aperture; it is said by M. Fagot to be the prevalent Spanish form, and has been definitely reported from Barcelona and other places in Catalonia.

Portugal—The typical form and var. *minor* are recorded by Morelet and Prof. Nobre from Valborn, and the public cemetery and environs of Oporto in the province of Minho ; Prof. Nobre also cites Lisbon and Setubal, Estramadura ; Abrantes in Alemtejo, and near Vila Nova de Gaia in Beira.

ITALY.

Probably diffused over the whole of Italy, definite records being accessible for Apulia, Abruzzi, Calabria, Campania, Emilia, Liguria, Lombardy, Marches, Piedmont, Romana, Tuscany, Umbria, Venetia, and the Islands of Sardinia, Sicily, Capri, etc.

H. syracusana Bourguignat is only an insignificant variety of *T. cartusiana*, and was based on specimens from Syracuse sent to him by Benoit.

SWITZERLAND.

M. Charpentier records it from hedges and from the banks of Lake Leman in the environs of Geneva, and from Canton Vaud, at Lausanne and Glérolles, Dr. Bollinger from Orbe, and M. Roffiæn from Chillon and Gorge-du-Chauderon; Dr. Bollinger also cites it from several localities in Basel, Estavayer in Canton Fribourg, and Vaumarcus in Canton Neuchâtel; while Stabile quotes Lugano, Canton Ticino.

AUSTRO-HUNGARY.

Well distributed over the various countries of the empire, being recorded for Austria, Banat, Bosnia, Carinthia, Carniola, Croatia, Dalmatia, Galicia, Goritz, Hungary, Herzegovina, Illyria, Istria, Moravia, Odenburg, Pesth, Pressburg, Slavonia, Styria, Transylvania, and Tyrol.

BALKAN PENINSULA.

Greece—Recorded from Thessaly, Epirus, and Peloponesus, and the Islands of Corfu, Cephalonia, Zante, Eubœa, Crete, etc.; and as *H. olivierii* Mich. from Crete, the Sporades, Cyclades, etc.

Albania—Recorded from Janina by Herr Clessin; and Avlona by von Martens.

Macedonia—Salonica ! J. A. Hargreaves. Wodena, Dr. R. Sturany.

Roumelia—In rejectamenta of the river Maritza at Dorfe Kadikej (P. Hesse, Nachbl., 1914).

Servia—Belgrade, Dr. Paetel.

Roumania—Recorded from Babadagh and Matein in Dobrudscha by Clessin.

Bulgaria—Varna (Jickeli, Nachbl., 1874, p. 9).

Turkey—*Helix frequens* is recorded by Dr. Pfeiffer as found throughout Turkey; and also recorded by Clessin. *H. syriaca* is cited from Derkos near Constantinople by Dr. Sturany.

DENMARK.

Zealand—The typical form and var. *minor* of Westerlund are recorded by Mr. Schlesch as found by Mr. Niels Petersen of Copenhagen in the vicinity of the fortress of Jaegersborg near Copenhagen, but it may be remarked that the accuracy of these records is doubted by many Danish malacologists.

RUSSIA.

Recorded from Tchernigov, Taurida, and Volhynia; also from the Caucasus and Novorossisk, Kouban Territory, Transcaucasia; the var. *frequens* from South Russia; and its subsidiary form *obscura* from Transcaucasia.

SIBERIA.

Recorded by Middendorff from Irkutsk; and by Gude from the Amur Valley.

NORTH AFRICA.

Egypt—*Theba cartusiana*, Helwan near Cairo ! Mrs. Longstaff.

Helix syriaca, which is probably a variety of *T. cartusiana*, is recorded by Pfeiffer for Egypt.

Algeria—M. Bourguignat records *Helix fradiniana* Bourg., which is probably merely a form of the present species; and Dr. L. Pfeiffer also records *Helix syriaca* as a denizen.

ASIA MINOR.

Asiatic Turkey—Trebizond, Erzeroum, and Baibout, in province of Trebizond; Priene near Smyrna in Adana; and at Brussa.

Syria—Recorded from Jaffa, Palestine, by Mr. F. H. Sikes; and as *H. frequens* by Dr. Pfeiffer from Syria.

Genus *XEROPHILA* Held.

(Helicella, Férussac; Helicopsis, Fitzinger; Jacosta, Gray; Trochula, Schlüter; Turricula, Beck; Cochlicella, Risso, etc.).

Joaquin Gonz.l Hidalgo

THE genus *Xerophila* (ξηρός, dry; φιλέω, to love) is a subdominant group, which in evolutionarily active countries is chiefly restricted to arid ground, but if by accident or design any of its constituent species are transported to primitive and manifestly weaker regions, they may monopolize them, and oust the competing native species.

This group is dedicated with the highest respect to Dr. Joaquin Gonzalez Hidalgo, the distinguished Spanish conchologist, and professor of malacology in the University of Madrid, in recognition and appreciation of his great services to science, and the many valuable works he has produced, not only upon the fauna of Spain, but upon the Philippine Islands and other regions.

Prof. Pilsbry and others have affirmed the alliance of the present group and *Hygromia*, as evidenced by their similarly simply-lipped shells, simple form of dart, and the frequent duplication of the dart sac. This opinion is not corroborated by the general character of the shells, which in *Hygromia* are usually of an uniformly dull brown and bandless, with a thickened periostracum, while in *Xerophila* the shells are characterized by their white or whitish calcareous substance and varied dark zonal banding—incontestible evidences of a radically different environment and mode of life.

Internally these differences are emphasized in *Xerophila* by the perfect freedom of the reproductive organs from the right tentacular retractor, which in *Hygromia* passes between the male and female organs, while the stylophores or dart sacs possessed by the typical *Hygromiæ* are paired on each side of the vagina, and each pair arranged as a small inner and a larger outer sac, the outer one only being teliferous; whereas the stylophores of the typical *Xerophila itala* are of equal size, placed side by side, and develop a pair of slender, curved, and intercrossing darts, with a common lumen.

This arrangement in *X. itala* suggests that the ancestral form may have possessed a pair of teliferous sacs at each side of the vagina, one set of which has in *X. itala* quite disappeared, while the remaining set is at present in process of fusion; further progress in this degeneration is shown in *X. virgata*, which has now only a single dart, though its stylophore, by the occasional presence of an apical cleft, indicates that it was probably formerly similar to that of *X. itala*; while, according to Moquin-Tandon, the small and more primitive coast form (*X. virgata* var. *maritima* Drap.) invariably has the stylophore bluntly bilobed.

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JOHN W. TAYLOR, M.Sc.

SMITHSONIAN INSTITUTION
WASHINGTON EE. D.C.

Part 24 (pp. 113–160; and plates x and xi), Price 9/-.
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WITH the issue of **Part 24** we resume the publication of the "**Monograph,**" though with slight modifications, necessitated by the inordinate increases in the cost of labour and material. Although the increase of cost to Subscribers is far from being adequate to meet the enhanced expenses in which we are involved by its publication, it is hoped that these inflated costs will be more or less quickly reduced to such a level as to relieve us from the strain of this unsatisfactory position, and expedite the completion of the work.

It has also been decided not to break the continuity of Maps illustrating the geographical range of the different species, not only for the sake of consistency throughout the work, but also because the new boundaries between the various nations, set up by the Allies, will probably eventually prove to be more or less tentative.

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North Grange,

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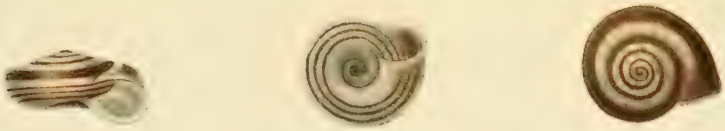
Prof W. H. Dall

With the respectful compliments

of the Author.

Edw W Taylor

XEROPHILA ITALA (L.) *and X. NEGLECTA* (Drap.)



Xerophila itala (L.) × 1½.
Royston, Cambridge, Mr. H. G. Fordham.

X. itala v. *alba* (Moq.) × 2.
Newquay, Cornwall, Mr. James.

X. itala v. *vitrea* (Wattebl.) × 2.
Iona, Rev. G. A. F. Knight.

X. itala v. *vitreozonata* Taylor × 1½.
Llandudno, Mr. J. R. le B. Tomlin.

X. itala var. *rubra* (Baudon) × 2.
Island of Mull, Mr. A. Somerville.

X. itala var. *bicolor* (Pascal) × 1½.
Mont St. Catherine, Rouen.

X. itala var. *lutescens* (Moq.) × 1½.
Evington, Leicester, Mr. Quilter.

X. itala v. *monozona* (Pascal) × 2.
Coleraine, Mr. Lionel E. Adams.

X. itala v. *bizonalis* (Pascal) × 1½.
Eastbourne, Mr. A. G. Stubbs.

X. itala v. *fasciata* (Moq.) × 1½.
Narin, Donegal, Mr. R. J. Welch.

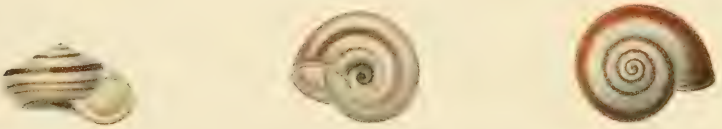
X. itala v. *coalita* (Pascal) × 2.
Eastbourne, Mr. A. G. Stubbs.

X. itala v. *hypozona* Taylor × 2.
Tenby, Mr. A. G. Stubbs.

X. itala v. *leucozona* (Moq.) × 2.
Durness, Mr. A. H. Pawson.

X. itala v. *lentiginosa* (Moq.) × 1½.
Gt. Blasket, Kerry, Mr. A. W. Stelfox.

X. itala v. *instabilis* (Jeffreys) × 1½.
Tiree Island, Rev. J. E. Somerville.



Xerophila neglecta (Drap.) × 2.
Luddesdown, West Kent, Mr. A. S. Kennard.

J. W. Taylor, del. ad nat.

Taylor Bros., Leeds.

The light thrown upon the relationship and affinity of the various forms by the more precise and intimate investigations of the present day, leads us to doubt the truth of the allocation of many species formerly associated together as simple variants of a common specific type, and though continental authors have discriminated between many forms of this and other groups in a much more analytical way than is usual in this country, this action was usually based chiefly or entirely upon shell characters; yet some of their proposed species have already been justified by a demonstration of certain differences in their organization as compared with that of the species to which they have hitherto been referred.

The various species of the group have been carefully studied by the Marquis di Monterosato, who has devised sectional names, variant of *Xerophila*, for the reception of the various types; thus he proposes *Xerolaxa* for *X. itala* and *X. pamplonensis*; *Xerocincta* for *X. neglecta*; *Xeroleuta* for *X. obvia*; *Xerogyra* for *X. bathyomphala* and *X. spada*; *Xerofriga* for *X. nubigena*, etc.; while Westerlund established a group as *Pseudoxerophila* for *X. instabilis* Ziegl. and allied forms, characterized by the shells bearing fine spiral striæ and rows of punctiform impressions.

The REPRODUCTIVE ORGANS show a well-developed penis and epiphallus, which is furnished with a strong retractor, and terminated by a short subulate flagellum; the stylophore may be incompletely bifid, reduced to a simple sac, or in extreme forms entirely lost or modified into an organ of analogous function; the gypsobelum or dart may be paired, single, or even wanting; the mucus glands are 8–25 in number; and the male element is transferred by means of a long, slender, and serrate spermatophore.

The MANDIBLE is wide and arcuate with many more or less prominent, flattened, diverging, transverse ribs, which denticulate the cutting margin.

The RADULA is of the usual type, with symmetrically trifid median teeth, asymmetrically bifid laterals, and trifid or quadrifid marginals.

The species of this genus are extremely variable and especially numerous in the Mediterranean region, where the species are inextricably interwoven. The genus is, however, quite rare in North Central Europe, where the chief evolutionary area is assumed to have been located.

According to Prof. Pilsbry, though the genus has been recorded from the Lower Miocene strata, there are few undoubted representatives before the advent of Pleistocene time.

FIG. 167.—Stonehenge, Salisbury Plain, in 1898, where *Xerophila itala*, *X. virgata*, etc., are abundant (photo. by the late Mr. J. Madison, Birmingham).

Xerophila italа (Linné).

1674 *Cochlea cinerea, fasciata, Ericetorum* Lister, Phil. Trans., vol. ix., p. 99, no. 105, pl. 6, f. 12.
1678 *Cochlea cinerea, albidâve, fasciata, Ericetorum* Lister, Hist. An. Angl., p. 126, tit. xiii., pl. 2, f. xiii.
1753 *Nerita integra, Striata* Klein, Method. Ostrac., p. 6, no. 11.
1767 *La grand Ruban* Geoffroy, Coq., p. 47, no. 13.

1758 *Helix* **itala** Linné, Syst. Nat., X ed., no. 598, p. 1245.
1777 — *albella* Pennant, Brit. Zool., iv,, p. 132, pl. 85, f. 122.
1778 — *erica* Da Costa, Brit. Conch., p. 53, pl. 4, f. 8.
1891 — *lampra* Westerlund, Verh. Zool. Bot. Ges. Wien., xlii., p. 25.
1826 *Helicella ericetorum* Risso, Hist. Nat. Europ. Merid., iv., p. 7.
1831 *Zonites ericetorum* Leach, Turton's Man., p. 101.
1833 *Oxychilus ericetorum* Fitzinger, Syst. Verz., p. 100.
1837 **Xerophila** *ericetorum* Held, Isis, p. 913.
1884 — (*Planatella*) *ericetorum* Clessin, Exc. Deutsch Moll., p. 187, f. 110.
1837 *Theba ericetorum* Beck, Ind. Moll., p. 13.
1892 *Xerolaxa ericetorum* Monterosato, Moll. Isole Adj. Sicilia, p. 24.

Ralph Tate.

HISTORY.—This is another species which was first discriminated and named, unfortunately polynomially, by Dr. Martin Lister, though Linné was the first author to apply a binomial designation as was established many years ago by Mr. Sylvanus Hanley, who in his examination of the Linnean Collection, now in the possession of the Linnean Society of London, detected the distinguishing numerals 598, which is the serial number of this species in the 10th edition of the Systema Naturæ, inscribed in Linné's well-known handwriting upon one of the specimens therein, which thus becomes the type of the species.

Some confusion arose later in reference to the precise numerals inscribed on the type shell, and conflicting statements were published, but this uncertainty was, we hope, finally set at rest by Mr. Edgar A. Smith.

There are four specimens of this species in the Linnean Collection, all below the normal size and all very similar in aspect. The type specimen is a tetrafasciate shell bearing the numerals 598, and showing the band arrangement 〓 in a faded and faint greyish-fawn colour.

I have pleasure in associating with the present species the late Prof. Ralph Tate, F.G.S., founder of the Belfast Natural History Field Club, and afterwards Professor of Natural History in the University of Adelaide, South Australia. He was the author of an excellent popular manual on our British land and freshwater mollusca published in 1866, and also prepared the invaluable Appendix to the revised editions of Dr. S. P. Woodward's famous classical work, "A Manual of the Mollusca."

Though other names have from time to time been added to the synonyms of this species, it is doubtful how far they can be accepted, as there are so many intermediate linking forms in existence and few or any of the pro-

posed synonyms are supported by any information as to the internal structure of the doubtful forms, so that implicit confidence cannot be placed in the accuracy of such references, although the light recently thrown on the relationship of various forms by the more rigidly precise investigations of modern scientists, lead us to doubt the strict identity with the present species of *X. instabilis*, *X. obvia*, *X. candicans*, etc.

The *Helix ericetorum* Nilsson is not our *X. itala*, but according to Dr. Gwyn Jeffreys is a very strongly striate shell, allied to our *X. caperata*; while Prof. von Martens has affirmed that the Swedish shells are identical with *X. striata* Schmidt. A specimen named *Helix nilssoniana* Beck, from Wurzburg, Bavaria, exhibited in November, 1912, at a meeting of the Leeds Conchological Club, on behalf of Mr. J. H. Ponsonby-Fane, was judged by its shell, a very finely but distinctly and regularly striate form of *X. virgata* or a closely-allied species.

The *Helix ericetorum* Drap. is likewise, judging by the figures, not referable to the present species, but appear to represent *X. neglecta*, while the figure of his *Helix cespitum* var. *β* has been considered to be a characteristic representation of *X. itala*. This confusion as suggested by M. Picard, is probably due to errors of the engraver.

Helix obvia, *Helix instabilis*, and *H. candicans* of Ziegler, and other forms have been described as synonymous with *X. itala*, but sufficient differences have been demonstrated in several of these cases to sustain their specific claims. *H. candicans*, according to Herr Hesse, is very distinct in structure, and this divergence is especially shown in the love-dart. *H. obvia* is described as more narrowly umbilicated, and as possessing two long straight darts; while *H. instabilis* is made the type of a new subgenus by Dr. Westerlund on account of the fine spiral striæ and rows of punctiform impressions on the shell.

Mr. Step ("Shell Life," p. 359) expresses his belief in the great probability of this and other unlikely species being evolved from *X. virgata*.

Diagnosis.—*Xerophila itala* is well distinguished from the allied species in this country by its subdiscoidal shell, wide umbilicus, and tubular whorls.

INTERNALLY, it stands absolutely alone amongst our teliferous British species in possessing paired darts or gypsobela within what is now a practically simple though distally bifid stylophore or dart-sac.

Description of Animal.—Scarborough specimens collected by Mr. J. A. Hargreaves in September, 1917, had long, slender, and almost colourless BODIES, but of a slightly darker greyish tint anteriorly; the whole upper surface was tuberculate, with only slightly perceptible DORSAL GROOVES, which enclosed a longitudinal row of elongate TUBERCLES, but no trace of facial or lateral grooves were detected; the MANTLE was colourless, with numerous whitish specks; and the RESPIRATORY ORIFICE was margined above, and on the right side, with white; the FOOT-SOLE was of a pale and uniform yellowish tint, with no perceptible trifasciation, but showing a narrow though indistinct FOOT-FRINGE, which was faintly lineolate; the OMMATOPHORES were slender and elongate, showing through their outer covering the pale grey RETRACTORS; the EYE SPECKS black and dorsally placed on the elongately bulbous extremities; the lower TENTACLES were slender and semi-transparent and the retractors only slightly pigmented.

Though the aspect of the animal may usually be as above described, yet the mantle in the albine forms is frequently of a dark leaden hue, of which shade the animal generally partakes, and intermediate forms connecting these extremes may also be found.

The presence of manganese in the tissues of mollusks is now being investigated by Prof. Boycott, who finds that the average quantity of this substance in the tissues of *X. itala* to be 0·0007 per cent. of the total weight of the animal.

The SHELL is very depressed and almost discoid above, but more convex and bombous below ; of a glossy, semi-opaque cretaceous substance, and of a greyish-white or pale greyish-fawn colour; the WHORLS are six in number, cylindrical and regularly increasing in size, the last somewhat dilated towards the aperture, with usually one broad dark spiral band above the periphery and several more slender ones beneath ; the SCULPTURE is somewhat irregular and plicate above, with finer intermediate striæ and numerous minute irregularly shaped pittings scattered over the surface ; the SPIRE is only slightly raised, and terminates in a brown and more or less pellucid apex ; the APERTURE is oblique, almost circular and slightly expanded ; the OUTER LIP is slightly reflected towards the columella and abruptly inflected above, with a slight internal submarginal rib or thickening ; SUTURE distinct; UMBILICUS very wide and open, exposing all the interior of the spire.

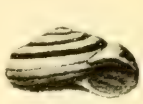


Fig. 169.

Fig. 170.

Fig. 169.—The Frontal aspect and Fig. 170.—Basal aspect of *Xerophila itala* (L.), natural size.
Tenby, S. Wales, Mr. W. H. Boland.

Diameter, 17 mill. ; altitude, 8 mill.

The INTERNAL STRUCTURE shows a pale buff KIDNEY or renal organ, of a somewhat elongate shape, tapering and curved like a broad bladed scythe. Moquin-Tandon describes this organ, under the name of "glande precordiale," as of a nearly opaque yellow colour, and elongately twisted like a horizontal ∽, while the HEART within the somewhat fusiform PERICARDIUM is appressed to the concave proximal margin ; the VENTRICLE is large and of an opaque-grey ; and the AURICLE is noticeably smaller, transparent, and colourless.

The ALIMENTARY SYSTEM displays an ŒSOPHAGUS which is very long, somewhat twisted, and uniform in thickness, the large yellowish-white SALIVARY GLANDS embracing the anterior third of its course, and discharging their secretion by a pair of short DUCTS ; the CROP is voluminous and elongate, and at its distal extremity is abruptly bent back upon itself and continued as the usual three tracts, or

Fig. 171.

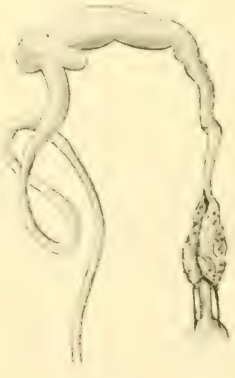


Fig. 172.

Fig. 171.—Alimentary tract of an adolescent example of *Xerophila itala*, from Charlton Kings, Gloucestershire ; from a dissection and sketch by Prof. Boycott, × 4.

Fig. 172.—Alimentary canal of an apparently abnormal example from Epsom, Surrey ; from a dissection and sketch by the late Mr. Charles Ashford, × 4.

courses of the gut, the RECTUM in its course passing close to the heart. The digestive gland or liver is usually of a light brown colour, and the hepatic arterial vessels are quite colourless.

In Mr. Ashford's original drawing of his dissection of a specimen of this species from Epsom, the distal extremity of the crop or stomach shows an asymmetrical pair of globose expansions, beyond which the stomach gradually diminishes in amplitude, and passes into the normal gut.

The CEPHALIC MUSCULATURE displays a very wide and strong pharyngeal retractor, the whole breadth of which is attached to the buccal bulb.

The tentacular and oral muscles arise from the same root and are fused together for a moiety of their total length, when the stout branch to the ommatophore of each side diverges, the muscle to the right ommatophore being quite free from

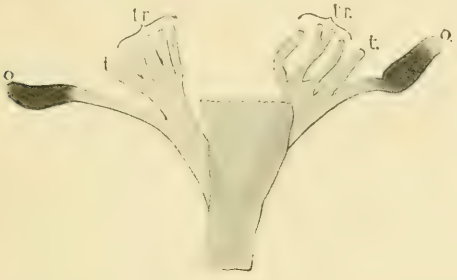


FIG. 173.

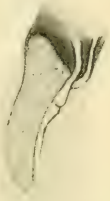


FIG. 174.

FIG. 173.—Cephalic retractors of an adolescent specimen of *Xerophila itala* from Charlton Kings, Gloucester; from a dissection and sketch as seen from beneath, by Prof. Boycott (greatly enlarged). *o.* ommatophore retractors; *lr.* labial retractors; *t.* anterior tentacular retractors. The retractor of the buccal bulb is the broad central band.

FIG. 174.—Kidney and heart of *X. itala*, also showing the rectum, etc., as viewed from beneath; from a dissection and sketch by the late Mr. Charles Ashford (greatly enlarged).

the sexual complex; the muscles serving the lower tentacles and the oral area are usually five on each side, and are not perfectly symmetrical, the stout outermost strand on each side of the body retracts the lower tentacles, while the remaining four are distributed to the lips and mouth-region generally.

The REPRODUCTIVE ORGANS display an elongate white OVOTESTIS; the HERMAPHRODITE DUCT is very sinuous and convoluted; the ALBUMEN GLAND of variable dimensions, according to the season, and separating into lobes after maceration in water; the VESICULA SEMINALIS is reniform, of a clear yellow, with fine blackish specks; the OVIDUCT is distinctly and very closely sacculate; the PROSTATE or sperm duct is comparatively broad; SPERMATHECA irregularly ovoid in shape and greyish-white in colour, borne on a moderately long and slender stem; PENIS-SHEATH short and somewhat clavate, continued as a long, twisted and tapering EPIPHALLUS, and terminating in a short subulate FLAGELLUM; the vaginal MUCUS GLANDS are somewhat irregular in number, and described by Moquin-Tandon as 4—10 on each side, verticillate, and inserted very high on the vagina; they are 5 to 8 millimetres long, slightly flexuous, and of a white colour tinged with greyish, but in British specimens are most usually 4—6 mill. in length, and 7—8 in number on each side.

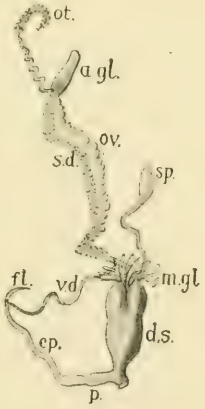


FIG. 175.—Reproductive system of *X. itala*, × 3, Epsom, Surrey.

a.g. albumen gland; *d.s.* twin stylophores or dart sacs; *ep.* epiphallus; *fl.* flagellum; *m.gl.* digitate vaginal mucus glands; *ot.* ovotestis or hermaphrodite gland with the sinuate hermaphrodite duct; *ov.* glandular or sacculate oviduct; *p.* penis; *s.d.* prostate or sperm duct; *sp.* spermatheca and its duct; *v.d.* vas deferens.

The STYLOPHORES or dart-sacs are formed externally of a pair of similar and simple sacs, whose lower parts are blended and fused to the VAGINA; the free DISTAL ENDS are ovate, bluntly pointed, greyish-yellow in colour, and speckled with brown. The sacs may, however, be unequally developed, and at times one may be more or less atrophied. Internally there is only a single lumen, which is bifid distally, each section or lobe bearing a tubercle resting upon the fundus of the sac, and supporting the base of its dart. The papillary common outlet of the darts may be sometimes perceived through the investing tissues, with the points of the two darts projecting from it.

The DARTS or gypsobela are two in number, 4–5½ mill. in length, and are comparatively large for the size of the animal. They have a curved and sometimes a strongly twisted hollow shaft, usually terminating when mature in a compressed

FIG. 176. FIG. 177. FIG. 178.

Enlarged details of the teliferous organs of *Xerophila itala* L.

FIG. 176.—Enlarged sectional view of the stylophore, showing the bilobation of the sac, and the darts in situ, × 4.

FIG. 177.—More highly enlarged view showing the basal attachment of the dart to the fundus of the sac; from a dissection and sketch, by the late Mr. Charles Ashford.

FIG. 178.—Gypsobelum or Love-dart of *X. itala* L., × 6; after Schuberth.

or flattened apex or point, the amount of compression varying, but the lateral edges do not develop into true blades. The base of each dart is without annulus, and no wider than the shaft, and rests upon the tubercle at the distal ends of the bilobed sac.

When freshly extracted the shaft is always somewhat transparent, the central cavity being filled with liquid, retaining numerous air bubbles which disappear a few minutes after extraction, after which the darts assume an opaque white aspect. The twin darts are usually but not invariably of equal size and the same degree of curvature, while their concave surfaces always face each other, and their free-pointed ends cross in their natural positions at rest within the sac, and would continue to further diverge on their extrusion.

Darts are almost invariably present in adult specimens, leading to the view that the spicula are not invariably lost during the preludes to conjugation, or that otherwise they are speedily renewed.

The JAW is quite crescentic in shape, about 1½ millimetres from side to side, and half millimetre in altitude; of a somewhat rufous-fawn colour, darkening in the thicker and overlapping parts, and bearing about eight transverse and somewhat divergent ribs, which are unusually broad and prominent especially medially, and project beyond the cutting margin, and still more strikingly on the upper border; there are also, sometimes, one or more slightly indicated ribs at one or both extremities of the jaw, and one or more perceptible lines or thickenings parallel with the upper and lower margins.

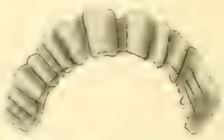


FIG. 179.—Mandible or jaw of *Xerophila itala* L., ×20, Chipstead, Surrey, from a preparation by Dr. E. W. Bowell.

The RADULA is of the usual oblong shape, about 3 millimetres in length and 1 millimetre in breadth, composed of 120 or more transverse rows of somewhat similarly sized teeth, which are slightly convergent to the median line of the radula; each transverse row of teeth is composed of a central longitudinal row of

FIG. 180.—Representative denticles from the radula of *Xerophila itala* Linné, also showing the relative positions of the cutting points of the succeeding row of denticles, from Chipstead Common, Surrey, prepared and micro-photographed by Dr. E. W. Bowell (× 330).

c. central or median tooth; *a.* admedian or lateral teeth; *m.* marginal teeth or uncini.

tricuspid teeth, each formed of a strong central cusp, with a supporting ectocone on each side, flanked by about twelve admedian or lateral teeth, which are mostly

bicuspid, and constituted by the mesocone and an ectocone; the marginals are about twenty in number, and also mostly bicuspid, but the ectocone gradually increases in importance as the margin of the lingual membrane is approached until it almost equals the mesocone in size.

The formula of the radula of a Chipstead specimen prepared and photographed by Dr. E. W. Bowell is

$$\frac{2}{2}\frac{0}{3} + \frac{1}{2}\frac{2}{3} + \frac{1}{3} + \frac{1}{2}\frac{2}{3} + \frac{2}{2}\frac{0}{3} \times 120 = 7{,}800 \text{ teeth.}$$

Reproduction and Development.—Few observations on the modes of reproduction have been made, but it is probable that the male element is transferred during conjugation by means of a filiform and serrate spermatophore.

Mr. Stubbs in the latter part of January, 1900, found a large colony on a sheltered sunny bank with a southern aspect, near Hertford, in active movement, and many of them in sexual conjunction, so that it is probable that in favourable seasons this act is continued more or less intermittently throughout the major portion of the year.

The late Dr. Kobelt has affirmed from direct observation in his terrarium that only one love-dart is extruded and used during the amatory preludes leading up to conjugation.

M. Bouchard Chantereaux records that *X. itala* lays its eggs from August to November; they are from 40–60 in number, agglomerated together in small clusters, and are about 1½ mill. in diameter, of a spherical shape, and of a dull white colour, due to the numerous crystals of carbonate of lime in the envelope.

Egg deposition has been frequently observed in Ireland by Mr. R. A. Phillips, both in the spring and autumn months, who remarks that the animal prepares a nidus by excavating a hole in the ground, about half-inch deep, and buries its body therein when depositing the eggs, which are probably afterwards covered with the earth.

The eggs hatch in about three weeks, the young shells being said to be uniformly horn coloured, becoming gradually more opaque and banded as they increase in size, and are adult towards the middle of the following year, the bulk of them usually dying off during their second hibernation.

Habits and Habitat.—*Xerophila itala* is a very sluggish and timid creature, shrinking within its shell at the slightest alarm. It is an eminently gregarious species, frequenting thistles, furze-bushes, etc., sunny and exposed grassy moorlands and pastures, or dry slopes and eminences.

X. itala is most plentiful on chalk or limestone soils, especially on the dunes, cliffs, and barren slopes of our coasts, but is also found on sandy or clayey soils, as well as in old quarries, broken ground, etc. The shell being more calcareous or more horny in accordance with the nature of the ground. Though frequenting the driest localities, it has the habit, in common with *Theba cantiana* and a few other species, of ejecting a comparatively large quantity of apparently pure water when roughly handled, and it is vouched for by Dr. Jeffreys and others that continued rains destroy great numbers of them.

It is a subdominant, or is perhaps more correctly described as a conditionally dominant, species, which is more or less restricted to comparatively inhospitable ground, and this apparent subdominancy is displayed at Tenby, Pembrokeshire, where Mr. A. G. Stubbs found that *X. itala* was driven off when the occupied ground was invaded by *H. pisana*; while

Mr. R. A. Phillips has remarked upon the absence of *X. itala* from the sandhills at Rush, near Dublin, where *Helix pisana* is found, though abundant on neighbouring sandhills where *H. pisana* is not present.

In Ireland and elsewhere it has been frequently observed in association with *X. virgata*, but in Northern France its companion on the dunes is said to be *Helix nemoralis*, and never *H. virgata*, which more frequently consorts with *H. hortensis*.

The shell is usually carried horizontally, but sometimes is borne at an angle of 45 degrees, while at the moment the shell is jerked forward in crawling it may be elevated to an angle of 80 degrees, or even more, as the shell is momentarily nearly vertically poised.

It affects exposed places, and is known to ascend beyond 5,500 feet, at which altitude it was found by Dr. Scharff, near Mürren, Canton Berne: in the Pyrénées it is recorded by Dr. Fischer as dwelling in the zone of *Helix nemoralis* at altitudes between 5,000 and 6,600 feet, but in the Alps it usually lives in altitudes ranging between 4,000 and 5,000 feet or slightly above the zone of cultivation. In the British Isles we have no records for altitudes exceeding the 1,000 feet, at which height it is recorded for Staffordshire.

Food.—The food of this species has not been systematically observed or recorded, but the late Mr. Baillie, of Brora, found that at the Kyle of Tongue, Sutherlandshire, the *Lotus* was their favourite food: but during showery weather, in July, 1883, he observed hundreds of them busily feeding on the decaying seaweed a little above high-water mark.

Mr. R. Standen, at Whitepark Bay, Ireland, where it is exceedingly abundant, found it in myriads after a damp night feeding on rabbit-droppings with which the scanty herbage of the sandhills is strewed.

On the continent, Dr. Hartmann records it as living amongst the Wild Thyme (*Thymus serpyllum*).

Hibernation and Æstivation.—In the continued dry weather of the summer months, the adults are stated to bury themselves in the earth, but the immature shells may often be found adherent to the vegetation, more especially to the long stems of the Couch Grass (*Triticum repens*). The summer epiphragm is very thin and more or less creased, transparent, iridescent, and glistening, with a large oval cretaceous spot above the respiratory orifice, but specimens collected by Dr. W. E. Clarke in May, 1889, at Tarascon, Bouches-du-Rhône, all formed a thick opaque-white epiphragm.

According to most observers, it usually retires for hibernation in this country about November, varying according to the season, hiding at the roots of grass and other vegetation or becoming ensconced in some suitable crevice or shelter, but this action is not invariable, as it has been found in mid-winter adherent to the stems of thistles and other plants even during periods of keen frost. The epiphragm at these times is usually though not invariably thick, opaque, and white.

Parasites and Enemies.—Like other species it is used as food by many birds, mammals, etc. The whimbrel (*Numenius phæopus*), the rock dove (*Columba livia*), the cream coloured courser (*Cursorius europæus*), and thrushes (*Turdidæ*) eat this species, according to Yarrell and other authors; while field mice feed upon them, according to the observations of Mr. C. E. Wright.

In the insect world it is preyed upon by the coleopterous *Drilus flavescens*, and *Ocypus oleus* is also accused by M. de Saussaye with destroying and feeding upon the species; while Herr von Linstow has described as *Cercaria ericetorum*, a caudate parasite developed from sporocysts found in this species.

A sarcophagous and possibly saprophagous Dipteron, *Sarcophaga nigriventris* Meigen, is recorded by Dr. E. W. Bowell as bred from a number of dead and moribund *X. itala*, collected on the common, by Chipstead Station, Surrey. Dr. Keilin never obtained this parasite from *X. itala* at Cambridge, though common there on other species.

Protective Resemblance.—The ochreous var. *lutescens* has been noted by Mr. Davy Dean as almost undistinguishable upon the dried grass amongst which it may be found, while the ordinary whitish form assimilates closely with the calcareous ground on which it is usually found.

Economic Uses.—According to Moquin-Tandon, this species is regarded as edible in France, and he especially mentions its use as food by the people of Avignon, Vaucluse.

In the British Isles, as in Sussex, and Bundoran, Donegal, the village children and others gather numbers of this and other species, threading them upon twine, and thus making necklaces and bracelets for their own adornment or for sale to tourists and others.

Mr. Swanton believes this use of the shells is a survival of an ancient custom, and speculates whether such bored shells have ever been found on pre-historic sites.

Geological Distribution.—*Xerophila itala* is apparently not reliably known below the deposits of Pleistocene age. The fossilized Irish specimens of this species are stated to present quite a different facies to the shells usually found in this country, the spire being more produced and the spiral banding more distinct and pronounced.

ENGLAND.

Pleistocene.—In England, it is listed by Mr. W. J. L. Abbott amongst the fossils found in the Ightham fissure, West Kent.

In Kent East, in a pre-Neolithic deposit, Barton Court, Dover, Rev. R. A. Bullen.

In South Essex, Mr. B. B. Woodward cites it from Pleistocene river drift at Grays; and Mr. J. P. Johnson records a form intermediate between *itala* and *virgata* from Uphall Brickyard, Ilford.

In Middlesex, Kennard and Woodward record it as present in the "Myles Collection," at the British Museum, as obtained from the sands exposed by the excavations in St. James Square, London, S.W.

In Norfolk W., it is recorded by Kennard and Woodward from the later layers of the Pleistocene or early Holocene deposits at Grimes Graves, near Weeting.

In Cambridgeshire, Mrs. McK. Hughes describes it as common in the deposits at Grantchester, Barrington, Barnwell Abbey, and Barnwell railway-station; and Kennard and Woodward remark that the Barnwell Abbey shells are "rather small and are decidedly flat, while those from Barrington are distinctly higher in spire."

FOREIGN DISTRIBUTION.

In **France,** it is recorded by M. Locard from deposits of Mid-Pleistocene age at Celle, Seine-et-Marne; by M. Fagot from the grey clays of the Quaternary period at Hers, Haute Garonne; by Dr. Germain as rare in loess at Neyron, Ain, as well as in the marls of Mouche and Gerland, Rhône; by Bouillet as common at bottom of the ancient lake of Sarliève, near Clermont, Puy-de-Dôme; by Caziot and Maury from the Pleistocene deposits about Nice, Alpes Maritimes; by Dr. Bouly de Lesdain from the Pleistocene dunes of Ghyvelde, Nord; and M. Locard from the quaternary beds about Lyons, Rhône.

In **Dalmatia,** M. Bourguignat reports this species as *H. vulgarissima* from the quaternary deposits of Sinj.

In **Greece,** M. Hilber has also recorded the same form from this country.

ENGLAND.

HOLOCENE.—Records for these comparatively modern deposits are more numerous.

In Cornwall W., in blown sands, Towan Head, J. P. Johnson; and from beneath a lacustrine deposit at Perranzabuloe by the Rev. R. Ashington Bullen.

In Dorset, under floor of arena of Roman Amphitheatre, called "Maumbury Rings," Dorchester, the specimens generally undersized! H. St. George Gray.

In the Isle of Wight, from the lacustrine beds at Totlands Bay (Forbes); and by Bristow from sub-ærial beds, St. Catherine's Down.

In Hants South, it was recorded by J. T. Kemp from tufa on river bank, near Waterworks, Southampton.

In Sussex West, it was found by Rev. W. A. Shaw in a deposit at West Stoke.

In Sussex East, from chalky rainwash, full of Neolithic flakes, overlying Palæolithic rubble drift, to the east of Brighton. J. P. Johnson, 1900. Deposit exposed by cliff wastage at Cow Gap Cliff, Beachy Head, Eastbourne, Rev. S. S. Pearce.

In East Kent, it was collected by Rev. R. A. Bullen from a deposit overlying the rubble drift at Barton Court, Buckland, Dover, and from a neighbouring deposit, in which a fragment of a Roman tile was found.

In West Kent, it is recorded by A. S. Kennard from a rainwash at Darenth, excavated in 1894–5, and as common in an early Neolithic interment at Cuxton. It has also been found at Ightham, beneath a tumulus in Stanley's Quarry, and by Mr. F. J. Bennett at Allen's Farm.

In Surrey, in chalk-pit, Woodcote Park, Epsom, July 1916! W. E. Cutler; and from a depth of 3 feet in a holocene deposit, Reigate, Lionel E. Adams.

In North Essex, it is recorded by J. French from the shell-marl of Felstead.

In South Essex, Dr. H. Woodward, records it from the shell-marl at the excavations for the East London Waterworks Reservoirs at Walthamstow; and it has also been found by Mr. W. J. Lewis Abbott in loamy clay at the Tunnel Cement Works, West Thurrock.

In Middlesex, it is recorded from Uxbridge by Kennard and Woodward.

In Oxford, it is recorded from Caversham by Kennard and Woodward.

In North Lincoln, it is recorded by Mr. C. S. Carter as common in a hillwash in a Romano-British excavation in the chalk at Ruckland near Louth.

In South-east Yorks., it was found by Mr. Mortimer in Barrow (No. 277) of the Bronze age, in Willie Howe Plantation, Sledmere, the specimens being preserved in the Mortimer Museum, Hull.

IRELAND.

In Antrim, Mr. R. J. Welch found this species quite common, washed out by a small stream from an exposed old land surface, now overlaid by about 15 feet of blown sand at the east end of Whitepark Bay.

In Donegal, Mr. Welch found *X. itala* commonly in the exposed earthy layers of an old land surface on the dunes at Narin, and also found examples in a greyish sandy old land surface at Rosapenna, and in the later "shell-pockets" as well as in an old "kitchen-midden" of uncertain age. The species was also common among some remains of an old land surface at Tranarossan, Rosguill peninsula, while at Carrickfin, Mullaghderg and Pollan bay he found it commonly in "shell-pockets," and less frequently at Bundoran under similar circumstances.

X. itala is also common in a deposit exposed in an ancient dune at Horn Head, discovered by Dr. Chaster and Mr. C. E. Wright, while Mr. Welch records it as present in myriads in a rainwash in an old dune on Tramore sandhills.

Mr. A. W. Stelfox found it common in a rainwash in the sand dunes at Inishmeane, and also obtained specimens from a deposit of blown-sand and bands of black-earth representing flood deposits at the mouth of the Ray river, Falcarragh.

In West Mayo, Mr. Welch found two specimens of *Xerophila itala* beneath a deposit of sandy peat in a marsh at Dooaghtry, Achill Island, and Dr. F. Corner found this species on the bed of a dried-up lough in the same island. Mr. Welch has also found examples in a section beneath a "kitchen-midden," exposed along the shore of the harbour on Clare Island.

In West Galway is the famous deposit at Dogs' Bay, Roundstone, discovered by T. Glover, of Manchester, and first described by R. D. Darbishire. It is described as an old sward, which showed as a black band in the section of the sand hills, but this is now apparently represented by a grey layer of earthy sand, and *X. itala* is common therein. On Inishbofin, it was found in a comparatively recent sand-dune deposit in course of formation, and also in an earlier layer by Mr. A. W. Stelfox.

In Clare, Mr. Welch found specimens of the present species in a rainwash of uncertain age at the Catacomb Caves, Edenvale; and Miss Diana Parkinson has detected it in the comparatively modern crannoge deposit at Clanreen.

In Kerry, it is recorded by Mr. Stelfox from a blown-sand deposit by Dingle Harbour, and also in a by no means modern deposit at Ferriter's Cove, Smerwick.

FOREIGN DISTRIBUTION.

In **France,** M. Dollfuss cites it from deposits of Roman age at Lyons-la-Forêt, Eure; and Caziot and Maury from the tufaceous beds exposed in the railway cutting near the Imperial Hotel, Nice, Alpes Maritimes.

Variation.—*Xerophila itala* is a member of a very difficult and complex group whose component members are so intimately linked together, structurally and conchologically, that until a thorough examination of the various doubtful forms has been made, it will be quite impossible to accurately determine their precise status.

Dumont and Mortillet have observed that the character of the shell varies in harmony with the features of the environment, the shell tending to become uniformly whitish, more calcareous and thicker in substance in arid places, fully exposed to the sun, but when living in shady places the shell tends to become less calcareous and more horny in character with the banding less distinctly marked. Dr. Paul Fischer found that in the volcanic region of Auvergne this species, like *Helix nemoralis* and *H. hortensis*, is characterized by pellucid and excessively thin shells.

The size of shell is very variable, ranging in diameter from about 8 millimetres to 25 millimetres or even more; the dwarfing is doubtless largely due to the hardships of their life conditions and the meagreness of the available food supply, while the larger forms are the result of more favourable conditions of life, though M. Beaudouin has especially remarked that in the Côte d'Or the larger specimens are more particularly found in very arid places, while the smaller forms dwelt among very varied surroundings.

The effects of altitude and the modifications of other features of the environment upon the shell of *X. itala* have also been studied by M. Debeaux, who affirms that in the valley of Baréges, Hautes Pyrénées, where the soil is naturally richer in soluble lime than the higher slopes formed solely of primitive rocks, the shells attain a good size (diam. 18 mill.), but are always thin and fragile, and the bands though present are quite pellucid.

On the Pic de Midau, at about 1,400 feet above the valley, the shells diminish in size, attaining only a diameter of 10—12 millimetres, while on the still higher altitudes of 4,800 feet and upwards to 6,000 feet, all traces of banding are lost, the shells are still further dwarfed, only attaining a diameter of 8—10 millimetres, and are thin and delicate and of an uniform "pale white."

The pigmentation of the shell differs in its shade and intensity of the ground colour, from white, through yellowish-fawn to very deep brown; and Mr. C. E. Wright mentions a very beautiful rosy-pink form, which he found at Roundstone, Galway. The bands also vary from being perfectly transparent through greyish or yellowish to brown, or rose-pink, etc., to almost black. The spiral banding generally shows a broad dark band above the periphery and several slender lines beneath, but these vary so much in number and character that scarce two specimens are exactly alike; the bands may also by transverse coalition and disruption present a radiate aspect on the upper side, this, according to Mr. Ashford, being the normal form in King's Co., Ireland; and Mr. A. W. Stelfox in June 1918 found a similarly marked and almost purely albine variety to be the prevailing form on Great Blasket Island, off the coast of Kerry.

The modifications of shape are chiefly those from a flat or greatly depressed spire to an elongate form, with the whorls almost dislocated as in var. *disjuncta* of Turton.

VARIATIONS IN FORM OF SHELL.

Var. **charpentieri** Moquin-Tandon.

Helix cricetorum var. *charpentieri* Moq.-Tand., Hist. Moll. France, 1855, p. 253.
Helix cricetorum var. *pyramidata* Baudon, Moll. Oise, 1862, p. 25.
Helix cricetorum var. *instabilis* Jeffreys, Brit. Conch., 1862, vol. i, p. 216.
Helix morbihana Bourguignat in Locard's Prodr., 1882, pp. 97 and 321.
Helix cricetorum var. *servierensis* Germain, Moll. Maine-et-Loire, 1903, p. 121, pl. 2.
Helix cricetella var. *alta* Caziot, Moll. Monaco, 1910, p. 277.

The var. **charpentieri** Moq.-Tand. is described as a little less depressed with an umbilicus in conformity.

The sub-var. **pyramidata** Baudon is extremely convex and pyramidal, and tends to become scalariform.

FIG. 181.

FIG. 182.

FIG. 181.—*X. itala* var. *pyramidata* Baudon, near Compiègne, Oise (after Baudon).
FIG. 182.—*X. itala* var. *morbihana* Bourguignat, Auxerre, Yonne (after Caziot).

The sub-var. **morbihana** is distinguished from the type by its more conical form, its convex, quite cylindrical whorls, narrower umbilicus, and its dilated, thickened, and yet sharp peristome. The shell is also usually white and somewhat glossy, but is sometimes fasciated.

The sub-var. **servierensis** Germain is more elate, conico-convex above, with narrower umbilicus, finely and regularly striolate. Diam., 11–15 mill.; alt., 8½–11 mill.

FIG. 183.

FIG. 184.

FIG. 185.

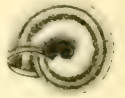


FIG. 186.

FIG. 183, 184.—*X. itala* var. *servierensis* Germain, Beaulieu, Maine-et-Loire, France × 1½.
FIG. 185, 186.—*X. itala* var. *instabilis* Jeffreys, Tiree Island, Rev. J. E. Somerville, × 1½.

The sub-var. **instabilis** Jeffreys is described as shell smaller, of a darker colour and sometimes streaked or spotted; spire more raised; umbilicus narrower.

The sub-var. **alta** Caziot is not described or figured, the name being probably regarded as descriptive.

The variety from Iona, recorded by Dr. Jeffreys as var. *instabilis* Ziegler, is probably not that form, but until a knowledge of its internal structure is available, had perhaps best be included under this head.

Living specimens referred to the var. *instabilis* Jeffr., collected in the Isle of Tiree, by Rev. J. E. Somerville, examined in 1889, did not exsert the body much beyond the shell when crawling, the back and sides were very dark bluish-black, the body tubercles distinct but not crowded, tentacles moderately long and slender, dark grey in shade, becoming paler distally; foot-sole yellowish, foot fringe with transverse lineations. Possibly it may be shown to be structurally different from *X. itala* when carefully examined.

BRITISH DISTRIBUTION.

England—Specimens with a more or less elevated spire have been recorded from Winchester, Hampshire; Eastbourne, East Sussex; Durdham Downs, Gloucester; Clevedon, North Somerset; Porthywaen Quarries, Shropshire; Skegness, North Lincoln; Birstwith, Mid-West Yorkshire; and Kirkmichael, Isle of Man.

Scotland—Fife; Isle of Eigg, North Ebudes; Killoran Bay, Colonsay, South Ebudes; Isles of Iona and Tiree, Mid Ebudes; also on Barra and Butt of Lewis, Outer Hebrides; and sub-var. *instabilis* is cited by Dr. Jeffreys from Mull, and Iona, and was found on Tiree Island by Rev. J. E. Somerville.

Ireland—Phœnix Park and Malahide, co. Dublin; Clara, King's co.; Achill Island, West Mayo; Gleninagh, Clare, and Strabally, Kerry.

The sub-var. *instabilis* Jeffr. is recorded from Connemara, Galway, by Jeffreys.

FOREIGN DISTRIBUTION.

France—The var. *charpentieri* is cited by Moquin-Tandon on the authority of M. Charpentier, from the steep banks of the canal, Toulouse, Haute Garonne; by M. Henri Cardot as found rarely at Hautrecy, Ardennes; from St. Jean de Luz, Basses Pyrénées, by Mr. F. H. Sikes; and by M. Locard from Lyons, Rhône.

Sub-var. *serrierensis* recorded as rare on stems of *Foeniculum*, Roche-Servière, Beaulieu, Maine-et-Loire, by Dr. L. Germain.

Sub-var. *pyramidata* is cited from the road between Compiègne and Bienville, department of the Oise, by Dr. Aug. Baudon.

Sub-var. *alta* is described as found to the north of the Nice Observatory, and at Grasse, Alpes Maritimes by Comm. Caziot.

Sub-var. *morbihana* is known from Morbihan; Comm. Caziot records it from Auxerre in the Yonne; and Dr. L. Germain from Angers, Maine et Loire.

Belgium—Var. *charpentieri*, Rochefort, Namur, recorded by M. J. Colbeau.

Var. **scythropa** Westerlund.

Helix lampra var. *scythropa* Westl., Verh. Zool. Bot. Ges. Wien, vol. xlii, p. 25, 1891.

This variety shows characters not altogether in harmony with *Xerophila itala*, and may prove to be distinct. It is a much smaller shell, and much more narrowly umbilicated than is usual in *X. itala*; the spire is also more exserted, the whorls 5½ in number, and the margins of the aperture much more widely separated. Diam., 10 mill.; altitude, 6 mill.

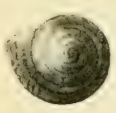


FIG. 187.

FIG. 188.

FIG. 189.

FIG. 187—189.—*X. itala* var. *scythropa* Westl. × 1½. Aran Isles, Galway, Sept. 1892, Dr. Scharff (named by Dr. Westerlund).

It was described as a variety of *Helix lampra*, but it is not improbable that the var. *scythropa* may prove to be a distinct form.

IRELAND.

Galway W.—Aran Isles! R. F. Scharff.

Var. **planorbis** Picard.

Helix ericetorum var. *planorbis* Picard, Moll. Somme, 1840, p. 235.
Helix ericetorum var. δ Pfeiffer, Monog. Helic. Vivent, 1848, vol. i, p. 163.
Helix virgultorum Bourguignat in Locard, Prodr., 1882, pp. 97 and 323.

The var. **planorbis** Picard has a shell perfectly flat, like a *Planorbis*, the apex being only slightly risen, and may be variously banded, the suture follows the keel-line almost or quite exactly.

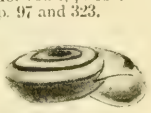


FIG. 190.—*Xerophila itala* var. *planorbis* Picard. Watlington, Oxfordshire. Mr. A. H. Pawson.

The sub-var. **virgultorum** Bourg. is described by Comm. Caziot as shell very depressed, with a funnel-shaped umbilicus, and a narrow circular aperture. Diam., 12–13 mill.; alt., 6 mill.

BRITISH DISTRIBUTION.

Oxford—The var. *planorbis* inhabits an elevated pasture, at Howe Combe, Watlington, July 1907! A. H. Pawson.

Nottingham—Specimens with a flat spire recorded from Winthorpe by the Rev. Revett Sheppard (Linn. Trans., 1825, vol. xiv, p. 160).

Pembrokeshire—Pembroke, 1885! Chas. G. Barrett.

Cheshire—Chester, 1886! J. R. le B. Tomlin.

Fifeshire—Links, Elie, Aug. 1886! T. Scott.

FOREIGN DISTRIBUTION.

France—The var. *planorbis* was described from specimens found in the Somme, and Grainger records a depressed variety (var. *subuliraga* Mabille) from Bidasoon, Basses Pyrénées.

The sub-var. *virgultorum* is recorded by Abbé Letacq from the plain of Alençon, department of the Orne; by Comm. Caziot as found at an altitude of 2,400 feet to the north-west of St. Vallier-de-Thiey, Alpes Maritimes; and by Dr. L. Germain for Durtal, Maine et Loire.

Var. **devians** Westerlund.

Helix ericetorum var. *devians* Westerlund, Nachbl. Deutsch. Mal. Ges., 1875, p. 72.

The var. **devians** has the shell widely umbilicated, the last whorl expanded at the aperture, which bears a strong inner rib. Diam., 15–18 mill.; alt., 8 mill.

BRITISH DISTRIBUTION.

England—Var. *devians* is recorded by the author as existing in the fasciate form at Clevedon, North Somerset.

FOREIGN DISTRIBUTION.

France—Var. *devians* is, according to Dr. Westerlund, found at Agen, Lot-et-Garonne, in the unicolorous white form.

Germany—The *fasciata-minor* form is recorded from Saalfield, East Prussia.

Var. **minor** Picard.

VARIATIONS IN SIZE OF SHELL.

Helix ericetorum var. *minor* Picard, Moll. Somme, 1840, p. 235.
Helix ericetorum var. *minor* Pfeiffer, Mon. Helic. Vivent, 1848, vol. i, p. 163.
Helix ericetorum var. *minor* Moquin-Tandon, Hist. Moll. Fr., 1855, vol. ii, p. 253.
Helix ericetorum var. *minor* Dum. & Mort., Moll. Savoie, 1857, p. 59.
Helix ericetorum var. *minor* Jeffreys, Brit. Conch., 1862, vol. i, p. 217.
Helix ericetorum var. *minor* Bourg., Mal. Alger., 1861, vol. i, p. 257, pl. 30. ff. 6—8.
Helix ericetorum var. *minor* Westerlund, Palæarct. Binnenconch., 1889, p. 338.
Helix ericetorum var. *intermedia* Gassies, Moll. Agenais, 1849, p. 47.
Helix ericetorum var. *minor* Caziot, Moll. Yonne, 1908, p. 215.
Helix ericetorum var. *minima* Kickx, Syn. Moll. Brabantiæ, 1830.
Helix ericetorum var. *tardyi* Bourg., Cat. gén. Franç., 1882.
Helix ericetorum var. *minor* Germain, Moll. Maine et Loire, 1903, p. 121.

The var. **minor** Picard is described as "shell half-size of type form, spire convex, and banding somewhat intense"; sub-var. *minor* Pfeiffer as 11 mill. diam. and 5½ mill. alt.; sub-var. *minor* Moquin as "much smaller than type, but of same form"; sub-var. *minor* Dum. & Mort. as 8–9 mill. diam.; sub-var. *minor* Bourg. as shell small, usually zoned, diam. 12–14 mill., alt. 6–7 mill.; sub-var. *minor* Westerlund as 9–11 mill. diam. and 5 6½ mill. alt.; and sub-var. *minor* Caziot as having 5½ whorls and a diam. of 12 mill. and an alt. of 5 mill. The sub-var. *minor* Germain is half the usual size, thin, yellowish-horn colour, with clear, fawn semi-transparent bands.

Fig. 191.—*X. itala* var. *minor* Picard. Wheatley, near Oxford. Rev. S. Spencer Pearce.

The sub-var. **intermedia** Gassies is described as smaller than the type form, the smallest dimensions being given as 7 mill. diameter. The var. *intermedia* of Dum. et Mortillet (Moll. Savoie, p. 59) is a much larger form, varying from 11–14 mill. in its smallest diameter.

Sub-var. **minima** Kickx, from Brabant, Belgium, is probably the very small form.

The sub-var. **tardyi** Bourguignat is characterized by the expansion of the umbilicus and of the termination of the last whorl. Diam., 8 mill.; alt., 3½ mill.

The *Helix ericetella* Jousseaume is regarded as a var. *minor* of *itala* by Drs. Baudon and Kobelt, but is considered distinct by M. Locard and Dr. Germain. M. Locard saying it is distinguished from *X. itala* by "its more depressed shape, especially towards the last whorl, its thinner shell, more regular coiling, narrower umbilicus, rounder aperture and reflected peristome."

This stunted and dwarfed form, which Moquin-Tandon and Dupuy regard as a northern variety, has been verified from very numerous localities in this country and abroad, and may probably be met with wherever the species is plentiful. The smallest specimens I have seen—about 8 mill. in diameter—were found by the Rev. S. Spencer Pearce at Wheatley, near Oxford, and are probably var. *minima* Kickx.

BRITISH DISTRIBUTION.

England—This variety has been seen and verified from West Cornwall, Somerset, North Wilts., Hampshire, Sussex, East Kent, Surrey, Middlesex, Berks., Oxford, Suffolk, Norfolk, Cambridge, Northampton, West Gloucester, Warwick, Stafford, Salop, Lincoln, Nottingham, Derby, Cheshire, Yorkshire, Durham, Westmorland. The sub-var. *minima* has been found at Lewes, East Sussex, by Mr. C. H. Morris, and by the Rev. S. Spencer Pearce at Wheatley, Oxford.

Scotland—Fife, South and Mid Ebudes, and West Sutherland.
The sub-var. *minima* has been found at Durness, Sutherland, by Mr. A. H. Pawson.

Ireland—Londonderry, Antrim, West Mayo, West Galway, and North Cork.

FOREIGN DISTRIBUTION.

Germany—Reported from Nieder Kaufungen near Cassel, by Mr. P. W. Munn; from Nassau by Prof. von Martens; and from the Eifel, South Rhineland, by Dr. Böttger.

Belgium—Recorded from Namur at Hastière by van den Broeck; and by M. Jules Colbeau from Rochefort.

Sub-var. *minima* is recorded from Biez, Brabant, by M. Colbeau.

France—Reported from the Basses Pyrénées at St. Jean de Luz! and Hendaye! by Mr. F. H. Sikes; and from Eau Bonnes! by Dr. Scharff; In the Hautes Pyrénées it is recorded from Mont Péguère, Cauterets, by Dr. P. Fischer; and from Gavarnay, at 4,500 feet altitude, by Mr. F. H. Sikes; from the Côte d'Or at Champdôtre by Capt. Wattebled; from the Somme, near Amiens, by M. Vaniot; from Chemilly, Nievre, by M. Breviere; from Angers, Maine-et-Loire, by Dr. L. Germain; from the ruins of Vendôme Castle! and at Bury near Blois! in Loir-et-Cher, as well as from Indre-et-Loir, at Loches! and on banks of River Loire at Amboise, by Mr. F. H. Sikes; from Champigny, St. Maur, etc., in department of the Seine by M. Pascal. It is also recorded from Morbihan by Taslé; the Oise, by Dr. Baudon; and by Dumont and Mortillet from Savoy.

Sub-var. *tardyi* Bourg. is recorded only from St. Claude, Jura.

Sub-var. *intermedia* Gassies is recorded from the Agenais.

Switzerland—Recorded from cantons of Basel, Schwyz, Unterwalden, and Uri.

Spain—Has occurred at Santander to Lieut.-Col. Parry, and was found by Dr. W. Eagle Clarke in May, 1889, at Canillo, Andorra, at an altitude of 5,700 feet.

Algeria—M. Bourguignat records this from Cap de Garde, near Bône.

Var. **major** Moquin-Tandon.

Helix ericetorum var. *major* Moquin-Tandon, Hist. Moll. France, 1855, p. 253.
Helix ericetorum var. *major* Dumont & Mortillet, Moll. Savoie, 1857, p. 59.
Helix ericetorum var. *major* Bourguignat, Mal. Alger., 1864, p. 257.
Helix ericetorum var. *major* Locard, Mal. Lyon, 1877, p. 48.
Helix ericetorum var. *major* Westerlund, Faun. Palæarct., 1889, p. 338.
Helix ericetorum var. *major* Caziot, Moll. Yonne, 1908, p. 216, pl. i, ff. 17, 23.

The var. **major** Moq.-Tand. is described as much larger (25 mill. diam. by 12 mill. alt.) but of type form; the var. *major* Dum. & Mort. is not less than 18 mill. in diam.; the var. *major* Bourgt. is of a dull whitish colour, and is 20 mill. in diam. and 12 mill. in altitude; the var. *major* Locard is 17 mill. diam.; the var. *major* Westerlund is 20–25 mill. diam. and 10–12 mill. in altitude; and the var. *major* Caziot is figured as about 19 mill. diam. and 8 mill. in altitude.

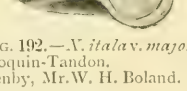


FIG. 192.—*X. itala* v. *major* Moquin-Tandon. Tenby, Mr. W. H. Boland.

ENGLAND AND WALES.

Sussex W.—Var. *major* D. & M. is recorded by Mr. W. Jeffery from Adsdean chalk pit and from roadside cuttings, though chalk, at Up Park and Kingly Vale.

Sussex E.—Var. *major* Westl., Eastbourne (20 mill. diam.) J. H. A. Jenner.

Kent E.—Dover, C. E. Wright, 1913.

Surrey—Woldingham Chalk Downs, in bleakest situations, K. McKean, 1883.

Northampton—Var. *major* Westld., a specimen 22 mill. in diameter from limestone quarry, Blisworth, Oct. 27, 1894, L. E. Adams.

Salop—Porthywaen Quarries, 1863, W. Whitwell.

Pembroke—The Burrows, Tenby! W. H. Boland.

IRELAND.

Limerick—Common about Limerick, attaining a diam. of 20 mill., H. Fogerty.

Kerry—A specimen (20 mill. in diam.), found at Ardport by Mr. A. W. Stelfox.

FOREIGN DISTRIBUTION.

France—The var. *major* is recorded from the Oise by Dr. Baudon; by Pascal from Mont Valerién, Seine-et-Oise; by Locard from the Rhône at La Caratte near Lyons, also from the Ain at Miribel and Vologuat; by Millet (25 mill. by 12 mill.) from Maine-et-Loire, and referable by their shape to the var. *planorbis* Picard; by Caziot for the department of the Yonne; from Chatillon-sur-Seine, Côte d'Or, by Beaudouin; and as *H. virgultorum* var. *major* from Durtal, Maine et Loire, by Dr. L. Germain.

Belgium—Recorded from Chokier by Piré; from Hastière, Namur (20 mill. diam.) by M. van den Broeck; and from Lombaertzyde, West Flanders (20 mill. diam.) by M. Colbeau.

Italy—Specimens, 18–20 mill. diam. recorded from Brescia, Lombardy, by Spinelli.

VARIATIONS IN SUBSTANCE OF SHELL.

Var. **vitrea** Dumont & Mortillet.

Helix ericetorum var. *vitrea* Dum. et Mort., Moll. Savoie, 1857, p. 59.
Helix ericetorum var. *vitrea* Wattebled, Journ. de Conch., 1889, p. 325.

The var. **vitrea** Dum. & Mort. is described as white, quite vitreous and transparent; the var. *vitrea* of Wattebled is transparent and of a whitish colour.

Fig. 193.—*V. itala* var. *vitrea* Wattebled, × 1½. Isle of Iona, Rev. G. A. F. Knight.

SCOTTISH DISTRIBUTION.

Ebudes Mid—The sub-var. *vitrea* of Wattebled, the Island of Iona! Rev. G. A. Frank Knight.

Main Argyll—Roadside, Acheran, Lismore! A. Somerville.

FOREIGN DISTRIBUTION.

France—Var. *vitrea* D. & M., banks of River Arve, near Geneva, Savoy, Dum. & Mort., l.c.; sub-var. *vitrea* Wattebled, rare at Champigny, Jura, Wattebled, l.c.; and Dr. Debeaux records white and excessively thin shells from Barèges, Hautes Pyrénées.

According to Dr. P. Fischer, in the volcanic region of Auvergne, the *V. itala* and certain other species are remarkable for their pellucid and excessively thin shells.

VARIATIONS IN COLOUR OF SHELL.

Var. **alba** Moquin-Tandon.

Helix ericetorum var. *b* Charpentier, Moll. Suisse, 1837, p. 12, pl. 1, f. 18.
Helix ericetorum var. *alba* Moquin-Tandon, Hist. Moll. France, 1855, p. 253.
Helix ericetorum var. *concolor* Picard, p.p. Moll. Somme, 1840, p. 235.

The var. **alba** Moq.-Tand. is described as entirely white.

The sub-var. **concolor** of Picard comprises a totally white form, but also embraces a reddish-white variety, from which I have separated it.

Fig. 194.—*V. itala* var. *alba* Moquin-Tandon.

The *H. ericetorum* var. *b* of Charpentier, which he describes as "tota alba," and as frequent in the neighbourhood of Bex, Switzerland, I have ventured to assume should be referred to var. *alba*.

Though it is by no means certain that any of these authors had the truly albine variety in view when describing this form, yet I have assumed them to have had knowledge of it, and that it was the form indicated.

The var. *alba* of Jeffreys is probably referable in part to the var. *concolor* D. & M. The true albine variety though uncommon is widely dispersed in this country, and also occurs on the continent, as has been firmly established by the efforts of Mr. F. H. Sikes and Dr. W. Eagle Clarke, but the foreign records are all more or less uncertain as to their precise nomenclature.

Mr. J. G. Milne mentions a small colony of the var. *alba* on Achill Island, near Dugort, in West Mayo, whose range was limited to an area of dry white sand, without noticeable vegetation.

BRITISH DISTRIBUTION

England and Wales—Its occurrence has been verified from Buckinghamshire, Berkshire, Cambridge, Carmarthen, Cornwall West, Denbigh, Derby, Devon North, Dorset, Durham, Essex North, Gloucester, Hants North, Hereford, Hertford, Kent, Leicester and Rutland, Lincoln North, Norfolk, Northampton, Northumberland, Nottingham, Oxford, Pembroke, Radnor, Salop, Somerset North, Suffolk East, Sussex East, Yorkshire, and Isle of Man.

Scotland—It has been verified for Mid Ebudes, Fifeshire and West Sutherland.

Ireland—It has been found in Londonderry, Antrim, Donegal, Dublin, King's County, Mayo, Galway, Clare, North Cork, and Kerry.

FOREIGN DISTRIBUTION.

France—Recorded from St. Jean de Luz, Basses Pyrénées! by Mr. F. H. Sikes; from Grasse, Alpes Maritimes, by Moquin-Tandon; and from the dunes of Dunkirk, Nord, by Dr. Bouly de Lesdain. It is also on record from the Gironde, Hautes Pyrénées, Landes, Oise, and Seine.

Switzerland—The var. *b* of Charpentier is noted as frequent about Bex, Canton Vaud.

Spain—Found by Dr. W. Eagle Clark in May, 1889, at 5,700 feet altitude at Canillo, Republic of Andorra!

Var. **concolor** Dumont & Mortillet.

Helix ericetorum var. *concolor* Picard p.p., Moll. Somme, 1840, p. 235.
Helix ericetorum var. *concolor* Dum. & Mort., Moll. Savoie, 1857, p. 59.
Helix ericetorum var. *bicolor* Pascal, p.p., Moll. Haute Loire, etc., 1873, p. 41.
Helix ericetorum var. *albescens* Germain, Moll. Maine et Loire, 1903, pp. 121, 122.
Helix ericetorum var. *alba* Jeffreys, British Conch., 1862, p. 217.
Helix ericetorum var. *bicolor* Pascal, p.p. Moll. Haute Loire, etc., 1873, p. 41.
Helix lampra Westerlund, Verh. Zool. Bot. Ges. Wein, 1891, vol. xiii, p. 25.

The var. **concolor** Dum. & Mort. is whitish; the sub-var. *concolor* Picard p.p. is reddish-white, and links up with Pascal's sub-var. *bicolor*.

Fig. 195.—*X. itala* var. *concolor* Dum. & Mort.

The var. **albescens** Germain is described as shell uniformly whitish or whitish-grey; the sub-var. *alba* Jeffreys is described as milk-white.

The sub-var. **bicolor** Pascal p.p., is described as without bands or spots, white and fulvous, the latter becoming stronger towards the aperture.

The var. *concolor* is probably also the *Helix obliterata* of Hartmann, and is not uncommon throughout the range of the species.

BRITISH DISTRIBUTION.

Somerset N.—Sub-var. *bicolor*, Compton-Martin! W. E. Brady.

Kent—Sub-var. *bicolor* Pascal was found by Mr. R. Cairns in this county.

Sussex E.—Sub-var. *bicolor* Pascal p.p. is recorded from near Lewes and Seaford by Mr. J. H. A. Jenner.

West Galway—Sub-var. *lampra*, Aran Isles! The specimens in my collection, received direct from Dr. Scharff, are referable to the var. *albescens* of *X. itala*.

FOREIGN DISTRIBUTION.

France—Sub-var. *bicolor* is recorded by M. Pascal from Bois de la Bernarde, Haute Loire, and from the Bois de Vincennes, Champigny, Choisy-le-Roi, Aubervilliers, Mont Valerian, etc., in the Seine et Oise.

Sub-var. *albescens* Germain is recorded from Angers, Maine et Loire.

Var. **lutescens** Moquin-Tandon.

Helix ericetorum var. *lutescens* Moq.-Tand., Hist. Moll. France, 1855, vol. ii, p. 253.
Helix ericetorum var. *lutescens* Baudon, Moll. Oise, 1862, p. 25.
Helix ericetorum var. *lutescens* Vaniot, Mem. Soc. Linn. Nord., 1883, p. 13.
Helix ericetorum var. *lutescens* Wattebled, Journ. de Conch., 1889, p. 325.

The var. **lutescens** Moquin-Tandon is described as uniformly dusky yellowish; the sub-var. *lutescens* Baudon (1862) is of an uniform dull yellow; the sub-var. *lutescens* Vaniot is yellowish without bands; the sub-var. *lutescens* Wattebled is uniform yellowish-white.

The var. *lutescens* Baudon (1884) is described as rufous-white, and is not strictly referable to the variety previously described by the author under the same name.

GEOGRAPHICAL DISTRIBUTION.

This variety is a fairly common form in this country wherever the species exists. It is also reported from France and Belgium.

Var. **rubra** Baudon.

Helix ericetorum var. *rubra* Baudon, Moll. Oise, 1862, p. 25.
Helix ericetorum var. *obscura* Moq.-Tand., Hist. Moll. France, 1855, vol. ii, p. 253.

The var. **rubra** Baudon is of an uniformly dark red-brown colour.

The sub-var. **obscura** Moq. would probably be best placed under this form. It is described as dark reddish, with brown banding, and large brown markings.

This variety has not been observed as yet in England, but Mr. Stelfox has found a variety with a distinct reddish-purple tinge at Dogs' Bay, Connemara, Galway.

SCOTTISH DISTRIBUTION.

Ebudes S.—A sub-var. of an almost uniform medium brownish colour, found by Mr. A. Somerville in the west of the Island of Mull, in August, 1894.

FOREIGN DISTRIBUTION.

France—Var. *rubra*, rare on the limestone hill of St. Laurent, Mouy, Oise (Baudon, l.c.), and recorded from Lente in the Drôme by M. Gustav Sayn.

Sub-var. *obscura* is cited from La Bresse and Belley in the Ain, and the environs of Lyons by Locard; also from Grasse, Alpes Maritimes, by Moquin-Tandon.

VARIATIONS IN THE BANDING OF THE SHELL.

This group is intended to embrace all banded shells of this species, taking cognizance of the modifications in the number, position, pigmentation, degree of development or disintegration of the bands, and their various modes of fusion.

Var. **fasciata** Gassies.

ONE BAND ABOVE PERIPHERY, ONE OR MORE BENEATH.

Helix ericetorum var. *fasciata* Gassies, Moll. Agenais, 1849, p. 97.
Helix ericetorum var. *fasciata* Baudon, Moll. Oise, 1852, p. 25.
Helix ericetorum var. *trivialis* Moquin-Tandon, Hist. Moll. France, 1855, p. 253.
Helix ericetorum var. *bizonalis* Pascal, Moll. Haute-Loire and Paris, 1873, p. 41.
Helix ericetorum var. *sexfasciata* Millet, Fauna, Maine-et-Loire, 1870, p. 26.

TWO OR MORE BANDS ABOVE PERIPHERY, ONE OR MORE BENEATH.

Helix ericetorum var. *fasciata* and *elegans* Moquin-Tandon, loc. cit.

BANDS SUPRAPERIPHERAL ONLY.

Helix ericetorum var. *monozona* Moquin-Tandon, loc. cit.

BANDS INFRAPERIPHERAL ONLY.

Helix itala var. *hypozona* Taylor, var. nov.

BANDS RADIATE.

Helix ericetorum var. *lentiginosa* Moquin-Tandon, loc. cit.

BANDS COALESCENT.

Helix ericetorum var. *coalita* Pascal, loc. cit.
Helix ericetorum var. *leucozona* Moquin-Tandon, loc. cit.

BANDS FAINTLY PIGMENTED.

Helix ericetorum var. β Draparnaud, Hist. Moll. France, 1805, p. 107.
Helix ericetorum var. *obliterata* Picard, Moll. Somme, 1840, p. 235.
Helix ericetorum var. *deleta* Moquin-Tandon, loc. cit.
Helix ericetorum var. *fasciata* Dum. et Mort., Moll. Savoie, 1857, p. 59.
Helix ericetorum var. *albidula* Bourguignat, Mal. Alger., 1864, vol. i, pl. 30, ff. 4—5.
Helix ericetorum var. *grisescens* Colbeau, Ann. Soc. Mal. Belg., 1865, vol. i, p. 33.

SHELL with one or more spiral bands, which may be distinct, coalesced, or variously broken up.

ONE BAND ABOVE PERIPHERY, ONE OR MORE BENEATH.

The var. **trivialis** Moquin-Tandon is described as possessing a single band above the periphery and one or more beneath, and is here regarded as the typical form of the species. The sub-var. **bizonalis** Pascal has one broad band above the periphery and a second which is narrower and occupies the centre of the last whorl.

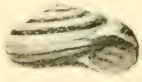


FIG. 196.

FIG. 197.

FIG. 196.—*X. itala* (L.), Tenby, South Wales, Mr. W. H. Boland.
FIG. 197.—*X. itala* var. *bizonalis* Pascal, Eastbourne, Mr. A. G. Stubbs, × 1½.

Many authors have not described the arrangement of the bands, and they therefore cannot be classified under the most appropriate heading, which is probably that of var. trivialis. *The sub-var.* fasciata *Gassies and the sub-var.* sexfasciata *Millet are both stated to possess six zonulations, but their arrangement is not indicated. The sub-var.* fasciata *of Baudon is stated to possess one to four bands, but no further information is available.*

The sub-var. fasciata *Dum. and Mort. is defined as possessing very feebly pigmented somewhat translucent bands, and will perhaps be most appropriately classified with the sub-var.* grisescens *Colbeau, and forming a link or passage with the var.* cornea *Locard.*

TWO OR MORE BANDS ABOVE PERIPHERY, ONE OR MORE BENEATH.

The var. **fasciata** of Moquin-Tandon is described as possessing many slender brown bands continuous above, and is here accepted as the type of *fasciata*, as that author was the first to precisely define the band arrangement, which distinguishes this form from var. *trivialis*.

The sub-var. **elegans** Moquin-Tandon has several narrow bands above the periphery which are alternately continuous lines or composed of spots.

BANDS SUPRAPERIPHERAL ONLY.

The var. **monozona** Pascal has only a single narrow band above the periphery, unicolorous and unbanded below.

BANDS INFRAPERIPHERAL ONLY.

The var. **hypozona** Taylor var. nov. has no bands above the periphery, but one or several below.

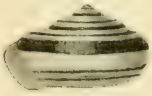


Fig. 198.

Fig. 199.

Fig. 200.

Fig. 198.—*X. itala* var. *fasciata* Moquin-Tandon, Narin dunes, Donegal, Mr. R. J. Welch, × 1½.
Fig. 199.—*X. itala* var. *monozona* Moquin-Tandon, Coleraine, Mr. Lionel E. Adams, × 1½.
Fig. 200.—*X. itala* var. *hypozona* Taylor, Tenby, Wales, Mr. A. G. Stubbs, × 1½.

BANDS RADIATE.

The sub-var. **lentiginosa** Moquin-Tandon has the deep brown bands broken up into spots and blotches and arranged in a radiate manner.

BANDS COALESCENT.

The sub-var. **coalita** Pascal has broader bands than ordinary which are coalesced at the mouth.

The sub-var. **leucozona** Moquin-Tandon has the shell rufous, the peripheral zone white, and usually many bands beneath.

BANDS FAINTLY PIGMENTED.

The sub-var. **obliterata** Picard has the shell whitish, with very pale and scarcely perceptible bands; it is the var. β of Draparnaud.

Fig. 201.

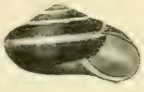


Fig. 202.

Fig. 203.

Fig. 201.—*X. itala* var. *coalita* Pascal, Eastbourne, Sussex, Mr. A. G. Stubbs, × 1½.
Fig. 202.—*X. itala* var. *leucozona* Moq.-Tand., Durness, Sutherland, 1905, Mr. A. H. Pawson, × 1½.
Fig. 203.—*X. itala* var. *albidula*, Algeria (after Bourguignat).

The sub-var. **deleta** Moquin-Tandon has pale and somewhat indistinct reddish markings above and brown bands beneath.

The sub-var. **albidula** Bourguignat is faintly banded.

The sub-var. **grisescens** Colbeau, with narrow, faint, ill-defined banding.

GEOGRAPHICAL DISTRIBUTION.

The var. *trivialis* Moq. and the loosely described sub-varieties *fasciata* of Gassies, Millet, and Baudon are common and widely distributed, as are the forms *albidula* Bourguignat, *grisescens* Colb., *deleta* Moq., *obliterata* Picard, and *fasciata* Dum. et Mort. in a much lesser degree.

The sub-vars. *coalita* Pascal and *leucozona* Moquin-Tandon are local forms, but often plentiful where they are found.

The sub-vars. *monozona* Moq. and *bizonalis* Pascal are by no means common forms, though on record for Eastbourne, Tenby, Cambridge, and other places in England and Wales as well as for France.

The sub-vars. *elegans* and *fasciata* of Moquin-Tandon are really quite rare in this country, though the var. *fasciata* has been found at Newquay, Cornwall, by Mr. J. H. James; at Gotherington, Gloucestershire, by the late Dr. J. W. Williams; Roundstone, Galway, Ireland, where it was found in Aug. 1889 by Mr. G. W. Mellors; and also from Dublin, where it was obtained in April 1887, by Dr. Scharff; but in France both forms are recorded from the Ain and the environs of Lyons by Locard. The var. *fasciata* has also been found near Bordeaux by Dr. Scharff.

The sub-var. *hypozona* has been collected at Tenby, Pembrokeshire, in Oct. 1890 by Miss F. M. Hele, and in 1895 by Mr. A. G. Stubbs.

The sub-var. *lentiginosa*, Great Blasket Island, Kerry, June 1918! Mr. A. W. Stelfox; there are also several other records of its occurrence in the British Isles in a more or less characteristic state, but truly distinctive specimens are far from frequent.

Var. **hyalozonata** Cockerell.

Helix ericetorum var. *hyalozonata* Cockerell, Naturalists' World, Dec. 1885, p. 223.

Shell pure white with translucent bands or markings.

This is a local and interesting albine form of the species, but it occurs more or less sporadically throughout the range of the species, and occasionally occurs within a limited area, associated with *virgata* and other species sharing the same peculiarity, implying that the local influences have probably contributed to its evolution and perpetuation.

The var. *lentiginosa* when in the albine transparently marked form may be known as *hyalozonata-lentiginosa*. This variety is the common form about Clara, King's Co., Ireland.

BRITISH DISTRIBUTION.

In England, it has been recorded or is known from West Cornwall, East Sussex, Bucks., Cambridge, Northampton, West Norfolk, South Lincolnshire, Cheshire, Mid-West Yorks., and the Isle of Man.

In Scotland, it has been found in Main Argyle, South, Mid, and North Ebudes.

In Ireland, it is known from Meath, Dublin, King's County, Clare, and East and West Galway.

FOREIGN DISTRIBUTION.

France—Collected by Dr. W. Eagle Clarke at Tarascon, Bouches-du-Rhône.

Var. **cornea** Locard.

Helix ericetorum var. *cornea* Locard, Ann. Agr. Lyon, 1879, f. Westerlund.
Helix ericetorum var. *subpellucida* Jenner, Journ. of Conch., 1891, vol. vi, p. 361.
Helix ericetorum var. *minor* Germain, Moll. Maine et Loire, 1903, p. 121.

The var. **cornea** is small and horn-coloured, with four transparent zonules.

The sub-var. **subpellucida** is described as possessing translucent brown banding, through which the body of the animal appears black, and links with var. *hyalozonata*.

It is also the var. *subhyalozonata* of Wright.

The sub-var. *minor* of Germain is by its other characters referable to the present form. It is described as thin, yellowish-horn tint, with clear fawn-coloured semi-transparent bands, and forms a connecting link with var. *lutescens* and var. *subpellucida* Jenner.

BRITISH DISTRIBUTION.

England—Sub-var. *subpellucida* is recorded by its author from Wilmington Hill, near Lewes, Sussex; and reported by Mr. E. J. Elliott from Stroud, Gloucester.

FOREIGN DISTRIBUTION.

France—Var. *cornea* is recorded from Savoy by Westerlund; and Bourguignat records a small horny variety with four transparent zonules from Aix-les-Bains.

The sub-var. *minor* of Germain is found near Angers, Maine et Loire.

MONSTROSITIES.

Monst. **sinistrorsum** Jeffreys.

Helix ericetorum var. *sinistrorsa* Jeffreys, Brit. Conch., i, p. 216, 1862.

Shell coiled sinistrally.

BRITISH DISTRIBUTION.

Huntingdon—Water Newton, Sept. 1912, a fine adult specimen, the var. *lutescens* in colouring (Rev. C. E. Y. Kendall), Journ. of Conch., Oct. 1913, p. 102.

Northampton—One specimen, Weldon, 1909, C. E. Wright.

York N.E.—A specimen, the var. *albescens* in colouring, found at Scarborough, was in the collection of the late Mr. P. B. Mason.

York S.E.—Bridlington (Jeffreys, Brit. Conch., i, p. 217, 1862).

Donegal—Several specimens obtained by Mr. J. R. le B. Tomlin from Bundoran.

FOREIGN DISTRIBUTION.

Europe—There is a specimen in the British Museum labelled "Europe."

France—Moquin-Tandon records three specimens: one from Tarbes, Hautes Pyrénées; one from Ceret, Pyrénées Orientales; and one from Lapene de Lheris.

Belgium—One specimen, the var. *grisescens* in colouring, collected near Namur in 1865 by M. Jules Colbeau.

Austria—One recorded by Rossmassler from the rampart-ditches of Vienna.

Bulgaria—One specimen, the var. *vulgarissima* in form, recorded by M. Mousson from Varna.

Monst. **disjuncta** Turton.

Helix elegans Brown, Wern. Mem., ii, p. 528, pl. 24, f. 9, 1818.
Caracolla elegans Brown, Ill. Brit. Conch., 1st ed., pl. 40, f. 28.
Helix disjuncta Turton, Conch. Dict., p. 61, pl. 16, f. 63, 1819.
Helix ericetorum Brown, Ill. Brit. Conch., p. 50, pl. 17, f. 28, 1844.
Helix ericetorum var. *scalaris* Grat. Cat., p. 7, 1855.

Shell scalariform and of a pyramidal form.

The remarkable shell upon which this variety was founded was at first referred to *H. arbustorum* by Baron Férussac, which view was to some extent shared by Dr. Turton, but who, however, decided to regard it as a distinct species, though afterwards, in his "Manual," he referred to it as *Helix virgata*. Specimens more or less closely resembling the typical shell have been recorded from time to time by various authors, and have generally regarded the specimens as most probably referable to the present species.

Fig. 204.—*X. itala* monst. *disjuncta* Turton. Golden Bridge, Dublin (after Turton).

BRITISH DISTRIBUTION.

Northampton—Harrington, Aug. 1904, Rev. W. A. Shaw.
Cheshire—Banks of River Dee, Chester, Oct. 1886, J. R. le B. Tomlin.
Yorks. S.W.—Sandal Castle Hill, Joseph Hebden.
Antrim—Crumlin, Dr. Kinahan (Nat. Hist. Rev., 1854, i, p. 159).
Dublin—The original specimen "was found in a field beyond Kilmainham Jail, near the Turnpike of Golden Bridge, Dublin, by Mr. Edward Stephens" (Brown, Wern. Mem., 1818, p. 528).
Galway East—A pyramidal specimen found at Gort, Oct. 1909 ! R. A. Phillips.

FOREIGN DISTRIBUTION.

France—Var. *scalaris*, Dax, Landes (Grateloup, l.c.).

Monst. **subscalaris** Baudon.

Helix ericetorum var. *subscalaris* Baudon, J. de Conch., xxiv, p. 254, pl. ix, f. 10, 1884.
Helix ericetorum m. *subscalare* Cockerell, Naturalists' World, Sept. 1888, p. 79.

The m. **subscalaris** Baudon is described as having the last whorl detached from the rest of the shell.

The m. **subscalare** Cockerell is described as "partly subscalariform."

Fig. 205.

Fig. 206.

Fig. 205.—*H. ericetorum* var. *subscalaris* Baudon, Chateau de Mello, Oise (after Baudon).
Fig. 206.—*X. itala* monst. *subscalaris* Baudon, Narrowdale, Derbyshire, J. and W. Hill.

BRITISH DISTRIBUTION.

Suffolk W.—Specimen in the British Museum, labelled "Bury St. Edmunds" (T. D. A. Cockerell, Nat. World, Sept. 1886, p. 179).
Northampton—Harrington, Oct. 1904, Rev. W. A. Shaw. Kettering, C. E. Wright.
Derbyshire—Narrowdale, near Hartington, May 1919 ! J. and W. Hill.
Isle of Man—Whitestrand Bay, Peel, Aug. 1892, W. Moss.

FOREIGN DISTRIBUTION

France—The m. *subscalaris* is recorded from Park of Chateau de Mello, Oise, by Dr. Baudon; by M. Gustav Sayn from Rousset-en-Vercors in the Drôme; and by M. Beaudoin from Chatillon-sur-Seine, Cote d'Or.

Geographical Distribution.—*Xerophila itala*, which is regarded by Dr. Scharff as originating in the Lusitanian regions of South-west Europe, is, according to our present knowledge, diffused over the greater part of the British Isles, though scarce or apparently absent from large areas in Scotland, Ireland, and Wales.

X. itala has been recorded as diffused more or less throughout Southern Europe, but it would appear possible that this may not be so, but that the species is represented in the Iberian peninsula by *X. pamplonensis*, etc.;

and in Italy by *X. ammonis*, *X. apennina*, etc. ; while in the East it is replaced by *X. derbentina* and other species ; and that all these may be regarded as earlier forms and more primitive in their organization and evolutionary status than the more dominant North Central European species, but these and other doubtful points cannot be finally and quite definitely decided until the internal structure of the various species has been thoroughly studied.

It was recorded for the Orkneys by Mr. T. S. Traill in 1830, but its occurrence there has not been confirmed by later writers.

On the continent it is said to be very widely diffused, being recorded from France, Belgium, Bohemia, Holland, Spain, Italy, Bulgaria, Roumania, Servia, Greece, Switzerland, Austro-Hungary, Russia, Transylvania, and Transcaucasia, but it is rare on the North German plain.

The true *X. itala* does not appear to occur in Scandinavia, and we have no precise records of its existence in Portugal.

In Asia it is recorded from Syria by Férussac, and by Prof. E. Forbes from several points in Pamphylia, Asia Minor. According to Westerlund, it was erroneously recorded by Gebler from Barnaul, Siberia.

In Africa, it is recorded for Algeria by Bourguignat and others.

In South Australia and New Zealand it is recorded as now locally plentiful, probably introduced amongst seeds, etc., from Europe, although the shells are in my opinion more precisely referable to *X. obvia*.

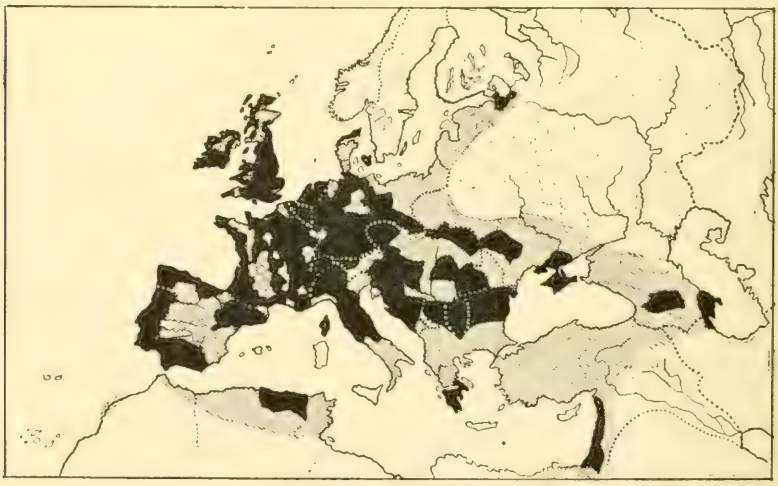


Fig. 207.—Geographical Distribution of *Xerophila itala* (Linné).

Probable Range Recorded Distribution

GERMANY.

Xerophila itala is found more or less locally almost throughout Germany, but chiefly in the west, including Alsace, Bavaria, Baden, Brandenburg, Cassel, Franconia, Hanover, Hesse, Hesse-Darmstadt, Holstein, Kurhessen, Lippe-Detmold, Lorraine, Luneberg, Mecklenburg, Nassau, Osnabruck, Pyrmont, Reuss, East, West, and Rhenish Prussia, Rhineland, Saxe-Coburg, Saxe-Weimar, Saxony, Silesia, Suabia, Thuringia, Westphalia, Wiesbaden, and Wurtemburg.

NETHERLANDS.

Holland—Reported from Bloemendal, North Holland, by Prof. E. von Martens.

Belgium—Recorded from Brabant, West Flanders, Hainault, Liége, Limburg, Namur, Luxemburg, and the Grand Duchy of Luxemburg.

FRANCE.

X. itala has been recorded from the following departments:—Ain, Agenais, Aisne, Allier, Aquitaine, Ardennes, Ariége, Aube, Aude, Auvergne, Alpes Maritimes, Basses Alpes, Basses Pyrénées, Bouches du Rhône, Brittany, Calvados, Charente Inférieure, Côte d'Or, Champagne Meridionale, Côtes-du-Nord, Drôme, Eure, Finistère, Gard, Gers, Gironde, Haute Garonne, Haute Loire, Haute Marne, Hautes Pyrénées, Hèrault, Ille-de-Vilane, Indre-et-Loire, Isère, Jura, Landes, Loir-et-Cher, Loire Inférieure, Lozére, Lot-et-Garonne, Maine-et-Loire, Manche, Meurthe-et-Moselle, Meuse, Morbihan, Niévre, Nord, Oise, Orne, Pas de Calais, Pyrénées Orientales, Provence, Puy-de-Dôme, Rhône, Sarthe, Savoy and Upper Savoy, Saône-et-Loire, Seine, Seine-et-Marne, Seine-et-Oise, Seine Inférieure, Somme, Tarn, Var, Vendée, Vienne, Vaucluse, Vosges, Yonne, and Isle of Corsica.

SWITZERLAND.

Charpentier states that this species is common throughout Switzerland, and it has been specifically recorded from the cantons of Aargau, Appenzell, Basel, Berne, Geneva, Glarus, Grisons, Lucerne, Neuchâtel, St. Gall, Schwyz, Unterwalden, Ticino, Vaud, Valais, and Zurich.

AUSTRO-HUNGARY.

Recorded from Austria, Bohemia, Carinthia, Carniola, Croatia, Dalmatia, Galicia, Goritz, Hungary, Styria, Transylvania, Tyrol, and Vorarlberg.

IBERIAN PENINSULA.

Spain—Reported by Prof. Hidalgo and others from various localities in Andalusia, Aragon, Asturias, Basque Provinces, Catalonia, Galicia, Guipuzcoa and Santander.

Portugal—Cited for Portugal by Prof. von Martens and Dr. Scharff, but without mention of precise localities.

ITALY.

Only known from the northern provinces and Sicily. The recorded areas are Abruzzi, Emilia, Lombardy, Marches, Piedmont, Rome, Tuscany and Umbria.

BALKAN PENINSULA.

Roumania—Reported from Bucharest, June 1914, by Mr. L. E. Adams.

Bulgaria—Recorded by Kreglinger for this region, and reported by Mr. Adams from Rustchuk and Sophia. The var. *vulgarissima* is cited from Varna by Jickeli.

Greece—The form *H. ericetorum* var. *græca* has been recorded from the Morea at Nauplia, and from Tripolizza to Patras, as well as from Phocis, the Ionian Islands and the Archipelago.

Bosnia—Westerlund records the var. *trivialis* from Serajevo and Zenica.

Servia—Reported from Belgrade, June 1914, by Mr. L. E. Adams.

Turkey—Cited by Prof. von Martens and Dr. Scharff, but without definite locality records.

SCANDINAVIA.

Norway—Though a single specimen of this species is in the "Sars" collection, said to have been found at Bygdo, near Christiania, this, according to Prof. E. von Martens, is not a "fresh" shell, but has been made the basis for including it as a Norwegian species, although the occurrence has never been confirmed.

Sweden—Though recorded by Nilsson as not uncommon in the Island of Oeland, the form found there is not strictly referable to the present species, but to a species allied to our *Helix caperata* and named *H. nilssoniana* by Malm and others.

Denmark—According to Steenberg, this species has not been found in Denmark for a half-century; the recorded localities being Zealand and North Jutland.

In Zealand, five shells were found by Lassen on a sandy hill between Bistrup and Stavnsholt; ten or twelve others on a sunny hill between Fredericksdal and Birkerod; and two specimens by Steenstrup from Bakkerne near Farum.

In North Jutland, it is recorded by Steenberg as having occurred at Aalborg, the specimens being now in the Strandgaards collection.

RUSSIA.

Reported by Prof. von Martens from the government of St. Petersburg, Tauria, and Caucasia; and by Krynicki for South Podolia, South Tauria, Georgia, and Transcaucasia.

SIBERIAN SUB-REGION.

Tomsk—Recorded by Gebler as occurring at Barnaul, but Westerlund believes the specimens to have been *Hygromia hispida* L.

ASIA MINOR.

Syria—Férussac (Tabl. Syst., 1822, p. 43), records this species for Syria; and Prof. Forbes cites the species as inhabiting the Travertin plains of Pamphylia, also the plains of the Yailah basin, the tertiary plains of the Valley of Xanthus, and the Plain of Phineka.

NORTH AFRICA.

Algeria—Bourguignat cites this species as rare in Algeria. It has been found at Constantine by Raymond; at Cap de Garde, near Bône, by Brondel; and at Metlili by Marès.

AUSTRALASIAN REGION.

South Australia—Dr. Cox, of Sydney, first observed and recorded in 1891 the occurrence of this species amongst "grass tussocks" at Levens, York Peninsula, probably imported with English grass, which was cultivated there for a few years. The species has now spread over hundreds of square miles, and in 1912 was so exceedingly abundant that the herbage in places was white over with the countless millions of their shells, while there is a marked tendency to spread westwardly to Coney Point and scarcely any progress eastward towards Warooka. Judging by the specimens examined by me, the species would in my opinion be more precisely defined as *X. obvia*.

New Zealand—Mr. F. W. Wotton records that in 1892 there was a thriving colony of *X. itala* at Wellington, North Island, the species being unwittingly introduced from England with grass seed some five or six years previously. The shell sent to me by Mr. Wotton is, however, precisely the same form (*X. obvia*) as those recorded above from South Australia.

FIG. 208.—Whitepark Bay, near Giant's Causeway, Antrim, where *Xerophila itala* is abundant and of large size (photograph by Mr. R. J. Welch).

Distribution of *Xerophila itala* (L.)

In the Counties and Vice-Counties of the British Isles.

ENGLAND AND WALES.

Channel Isles
PENINSULA
1 Cornwall W.
2 Cornwall E.
3 Devon S.
4 Devon N.
5 Somerset S.
6 Somerset N.
CHANNEL
7 Wilts N
8 Wilts S.
9 Dorset
10 Isle of Wight
11 Hants S.
12 Hants N.
13 Sussex W.
14 Sussex E.
THAMES
15 Kent E.
16 Kent W.
17 Surrey
18 Essex S.
19 Essex N.
20 Herts.
21 Middlesex
22 Berks.
23 Oxford
24 Bucks.
ANGLIA
25 Suffolk E.
26 Suffolk W.
27 Norfolk E.
28 Norfolk W.
29 Cambridge
30 Bedford
31 Hunts.
32 Northampton
SEVERN
33 Gloucester E.
34 Gloucester W.
35 Monmouth
36 Hereford
37 Worcester
38 Warwick
39 Stafford
40 Salop

SOUTH WALES
41 Glamorgan
42 Brecon
43 Radnor
44 Carmarthen
45 Pembroke
46 Cardigan
NORTH WALES
47 Montgomery
48 Merioneth
49 Carnarvon
50 Denbigh
51 Flint
52 Anglesey
TRENT
53 Lincoln S.
54 Lincoln N.
55 Leic. & Rutld.
56 Notts.
57 Derby
MERSEY
58 Cheshire
59 Lancashire S.
60 Lan'shire Mid
HUMBER
61 S.E. York
62 N.E. York
63 S.W. York
64 Mid W. York
65 N.W. York
TYNE
66 Durham
67 Northumb. S.
68 Cheviotland
LAKES
69 Westmorland and L. Lancs
70 Cumberland
71 Isle of Man

SCOTLAND.

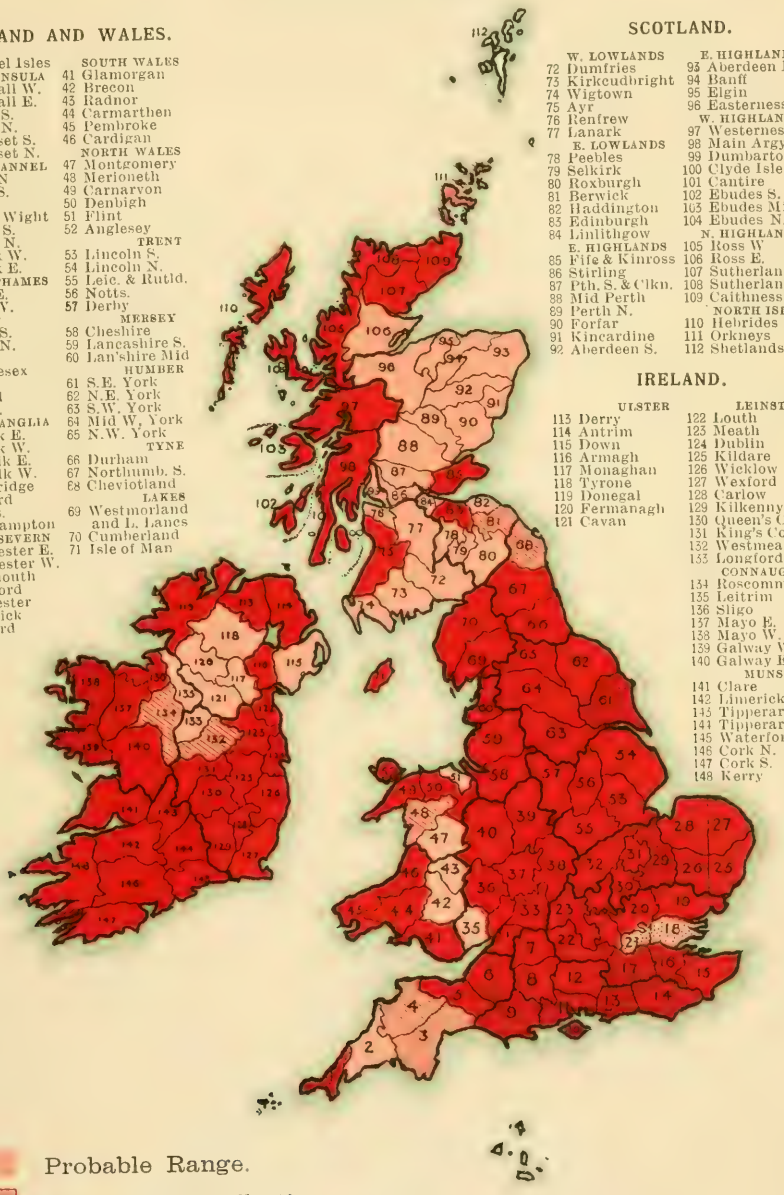
W. LOWLANDS
72 Dumfries
73 Kirkcudbright
74 Wigtown
75 Ayr
76 Renfrew
77 Lanark
E. LOWLANDS
78 Peebles
79 Selkirk
80 Roxburgh
81 Berwick
82 Haddington
83 Edinburgh
84 Linlithgow
E. HIGHLANDS
85 Fife & Kinross
86 Stirling
87 Pth. S. & Clkn.
88 Mid Perth
89 Perth N.
90 Forfar
91 Kincardine
92 Aberdeen S.

E. HIGHLANDS
93 Aberdeen N.
94 Banff
95 Elgin
96 Easterness
W. HIGHLANDS
97 Westerness
98 Main Argyle
99 Dumbarton
100 Clyde Isles
101 Cantire
102 Ebudes S.
103 Ebudes Mid
104 Ebudes N.
N. HIGHLANDS
105 Ross W
106 Ross E.
107 Sutherland E.
108 Sutherland W.
109 Caithness
NORTH ISLES
110 Hebrides
111 Orkneys
112 Shetlands

IRELAND.

ULSTER
113 Derry
114 Antrim
115 Down
116 Armagh
117 Monaghan
118 Tyrone
119 Donegal
120 Fermanagh
121 Cavan

LEINSTER
122 Louth
123 Meath
124 Dublin
125 Kildare
126 Wicklow
127 Wexford
128 Carlow
129 Kilkenny
130 Queen's Co.
131 King's Co.
132 Westmeath
133 Longford
CONNAUGHT
134 Roscommon
135 Leitrim
136 Sligo
137 Mayo E.
138 Mayo W.
139 Galway W.
140 Galway E.
MUNSTER
141 Clare
142 Limerick
143 Tipperary N.
144 Tipperary S.
145 Waterford
146 Cork N.
147 Cork S.
148 Kerry



Probable Range.

Recorded Distribution.

Distribution verified by the Author.

Geological Distribution.

SUB-GENUS *Heliomanes* Moquin-Tandon.

Xerophila neglecta Draparnaud.

1805 *Helix* **neglecta** Draparnaud, Hist. Moll. France, p. 108, pl. vi, ff. 12, 13.
1855 — (*Helicella*) *neglecta* Moq.-Tand., Hist. Moll., ii, p. 250, pl. 18, ff. 27-29.
1837 **Xerophila** *neglecta* Held in Isis, p. 913.
1837 *Theba neglecta* Beck, Index Moll., p. 13.
1892 *Xerocincta neglecta* Monts., Moll. Isole adj. Sicilia, p. 24.

HISTORY.—*Xerophila neglecta* was first discriminated, described, figured and named by Prof. Draparnaud about 120 years ago, and was very generally accepted as a valid species, although Dr. Heynemann regarded it as a somewhat narrowly umbilicated form of *X. itala*; while Comm. Caziot places this species along with more than a score of others as the type of a new group *Neglectiana*, arranging them into two sections.

Dr. J. E. Gray more than seventy years ago, recorded that this species had been admitted into the British list by Dr. Gwyn Jeffreys, who regarded it as a variety of *Xerophila virgata*. It has, however, been recently rediscovered in this country by Mr. A. S. Kennard, who in September, 1915, found specimens at Luddesdown, a village on the chalk formation, near to Cobham in West Kent, where it still exists.

The precise locality is a remote spot about three-quarters-of-a-mile from, and south-west of the village church, and is a grassy bank, about six feet high, which is really a gap in a road-side hedgerow. The species apparently continues to be restricted to the original spot, and judging from the dead shells to be seen around, must have existed there for many years.

I have pleasure in associating this species with the late M. Arnould Locard, of Lyons, one of the most distinguished and typical of the enthusiastic group of continental analytical conchologists, who have for so many years intensively studied and minutely differentiated the shells of France and other countries.

Moquin-Tandon figured the mandible, but little or no further progress was made until Prof. Boycott and Dr. Bowell examined the organization of the species, and it is to their studies that we are indebted for what little we know of its internal structure.

Diagnosis.—EXTERNALLY, *Xerophila neglecta* may be distinguished from *X. itala* by its smaller size, more elevated spire, the greater expansion of the last whorl, and narrower umbilicus. It also differs in the greater solidity of the shell, the much thicker apertural rib, and the usually rich brown peristome.

From *X. virgata* it is readily separated by its much more expanded umbilicus and its usually more depressed shape.

INTERNALLY, *X. neglecta* differs from *X. itala* by possessing one dart only, and by its distinctly bifid stylophore it is separable from *X. virgata*.

Original Description.—*Helix neglecta*, H. testa subdepressâ, albâ aut fuscescente, fasciata ; peristomate sordidè rubro, marginato.

Description of Shell.—SHELL somewhat depressed, convex beneath, and the SPIRE somewhat produced, WHORLS 5½, of an unicolorous opaque whitish or yellowish tint, or with one broad brown or fawn coloured band above the periphery, and several which may be distinctly defined or more or less broken up and coalescent below; the apex is smooth and glossy, horn coloured or blackish ; the upper whorls

FIG. 210.

FIG. 211.

FIG. 212.

FIG. 210.—*Xerophila neglecta* (Draparnaud), Lauserte, Tarn et Garonne, France (after Drap., pl. 6, f. 12, erroneously labelled *H. ericetorum*).

FIG. 211—Frontal and FIG. 212—Basal aspect of *Xerophila neglecta* (Drap.), Luddesdown, near Cobham, West Kent, Mr. A. S. Kennard, × 1½.

closely and distinctly striate, which become less distinct on the body-whorl, with stronger and coarser ribbings at short but not regular intervals ; the APERTURE is oblique rounded oval ; the PERISTOME reddish-brown or fawn coloured ; the internal submarginal RIB paler or whitish ; the UMBILICUS is moderately wide and open, exposing the whole of the spire. Diam., 14 mill. ; alt., 10 mill.

The EPIPHRAGM is somewhat thin, transparent, and iridescent, more or less creased, and with innumerable calcareous particles intermingled in its substance.

Description of Animal.—The ANIMAL is described as about 18 mill. long, and 4 mill. wide, thin and slender in form, and of a translucent yellowish-white, darker dorsally, and overspread with close-set rounded tubercles ; DORSAL GROOVES distinct and enclosing a row of large oval black speckled tubercles ; OMMATOPHORES about 8 mill. long, translucent grey, bulbous at the extremities, with distinct eye-spots near the summits, labial tentacles wide apart and obliquely directed ; the TENTACULAR RETRACTORS are visible through the transparent integument as longitudinally subdorsal bluish bands, arising from the base of each ommatophoral tentacle ; the MUZZLE is rather long, and the labial-lobes small. The fæcal lobe is large and triangular, and the columellar lobe is very narrow and crescentic.

The REPRODUCTIVE ORGANS show a distinctly sacculate OVIDUCT and a well-marked PROSTATE or sperm-duct ; the SPERMATHECA is somewhat large, acuminately clavate or club-shaped, and according to M. St. Simon greatly resembles in shape that of *X. explanata*, and is borne on a long and slender stem or duct ; the VAGINAL MUCUS-GLANDS are comparatively long, about 12 in number, some showing a tendency to dichotomize ; Moquin-Tandon describes a large specimen as possessing 14 small and grey mucus glands, of which 8 were on one side and 6 on the other ; the PENIS-SHEATH is of a moderate length, and tapering distally where the retractor muscle is affixed ; the EPIPHALLUS is long, about three times the length of the penis-sheath, thickest medially, and is probably in its natural position somewhat coiled or twisted ; the FLAGELLUM is short and pointed ; VAS DEFERENS is fairly long, and enters the epiphallus distally.

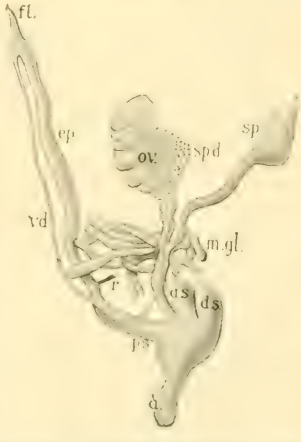


FIG. 213.—Reproductive organs o *Xerophila neglecta* Dr. × 4 (after Prof. A. E. Boycott).

a. atrium ; *a.s.* accessory dart-sac ; *d.* stylophore or dart-sac ; *ep.* epiphallus ; *fl.* flagellum ; *m.gl.* mucus glands ; *ov.* oviduct ; *p.s.* penis sheath ; *r.* penial retractor ; *sp.* spermatheca ; *sp.d.* sperm duct or prostate ; *v.d.* vas deferens.

The STYLOPHORE or dart sacs are basally united, but distinctly bifurcate distally, they are placed on one side of the oviduct, but only the outer and more muscular sac contains a dart, which is of a simple, slightly curved acicular type; the inner sac has slighter walls, and recalls the accessory dartless sacs of *Hygromia fusca*.

The MANDIBLE or jaw is somewhat crescentic in shape, slightly more than a millimetre in width, and about a fifth of a millimetre in altitude, with a noticeable, rounded, central rostrum or beak; there are about eight principal rather prominent and well separated transverse ribs, which do not perceptibly reach the lower or cutting edge, but very strongly denticulate the upper margin; each of these principal ribs usually show one or more subsidiary thickenings, and give a special aspect to the mandible. The whole mandible is of a fawn colour, and shows a darker line near to and parallel with the upper margin, which probably indicates a line of attachment to the buccal membrane.

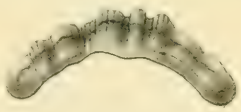


FIG. 214.—Mandible or jaw of *Xerophila neglecta* Drap. × 20.
Luddesdown, Kent.
From a preparation by Dr. E.W. Bowell.

The RADULA or odontophore is nearly 3 millimetres long, almost a millimetre wide, and is said to possess about 94 transverse rows of teeth, each row composed of a median symmetrically tricuspid tooth, about ten admedian or lateral asymmetrically bicuspid teeth, which tend to develop or retain indications of an endoconic elevation, and about twenty usually bicuspid marginals, which are still more asymmetrical, and towards the margin of the membrane may display an endoconic cusp on the membrane.

FIG. 215.—Representative teeth from the radula of *Xerophila neglecta* Drap., also showing the relative position of the cutting points of the next transverse row of denticles, from Luddesdown, East Kent, prepared and micro-photographed by Dr. E. W. Bowell, × 360.

c. central or median tooth; *a.* admedian or lateral teeth; *m.* marginal teeth or uncini.

The formula of the radula of a specimen from Luddesdown, prepared and photographed by Dr. E. W. Bowell, is

$$\frac{2}{2\text{-}3}\frac{0}{} + \frac{1}{2}\frac{0}{} + \frac{1}{3} + \frac{1}{2}\frac{0}{} + \frac{2}{2}\frac{0}{3} \times 94 = 5{,}734 \text{ teeth.}$$

Food and Habits.—Mr. A. S. Kennard records that nearly all the specimens were found high up on the grass stems, resembling in this the habit characteristic of *X. gigaxii*.

It is a very shy creature, retiring within its shell at the slightest cause. M. Draparnaud states that the animal has a voracious appetite, while Mr. Kennard records that it feeds freely upon lettuce and carrot while in captivity.

Geological Distribution.—So far as ascertained it is only known fossil by Prof. Pantanelli's Italian record from the Post-Pliocene Travertin at Colle, near Siena, Tuscany.

Variation.—The variation in this species has received little attention abroad, where it does not appear to be very well known, and as it has only been rediscovered in this country a few years ago and is apparently still restricted to the very limited original area where it was first found, we have naturally little knowledge of the modifications it may be liable to in this country.

On the continent several authors have drawn attention to certain divergences from the normal form which have been noticed, and have in several cases applied definite names, varietal or otherwise to them.

I enumerate the ten chief variations, and have reproduced the available information in reference to them.

VARIATIONS OF FORM.

Var. **subneglecta** Bourguignat.

Helix neglecta var. *subneglecta* Bourguignat, Mal. Chateau d'If, 1860, p. 15.
Helix neglecta var. *fagoti* Westerlund, Extram. Moll., 1878, p. 93.
Helix subneglecta Servain, Moll. Spain, 1880, etc., p. 103.
Helix subneglecta Caziot, Moll. Monaco, 1910, p. 268, pl. 3, ff. 40, 45.

The var. **subneglecta** Bourg. is described as having a more risen spire, a less open umbilicus, and more cretaceous and thicker shell. Diam., 7–11; alt., 5–7 mill.

The sub-var. **fagoti** Westl. is described as having a convex spire, an open umbilicus, the body-whorl obsoletely angulated at the periphery; aperture oval, and the margins not approximating.

Westerlund (Extram. Moll., 1878, p. 93) cites a variety with a subconical spire, but does not apply a definite name.

FOREIGN DISTRIBUTION.

France—The var. *subneglecta* is recorded from Chateau d'If, Bouches du Rhône, by Bourguignat; from Montpellier, Hèrault, by Dubrueil; and from various places in Alpes Maritimes by Comm. Caziot.

The sub-var. *fagoti* is recorded by Dr. Westerlund from Villefranche, Aveyron.

Italy—The var. *subneglecta* is recorded from Genoa, Alassio, Porto Maurizio, etc., Liguria, by Pollonera and Monterosato.

Algeria—The var. *subneglecta* is recorded from Bône and Alger by Westerlund.

Var. **depressa** Taylor.

SPIRE depressed.

Westerlund describes a form with depressed spire, but did not apply a definite name or give the locality where found.

VARIATIONS OF SIZE.

Var. **major** Westerlund.

Helix neglecta var. *major* Westerlund, Extram. Moll., 1878, p. 92.

SHELL larger. Diam., 20 mill.; alt., 20 mill.

The author does not state the locality where found.

Var. **minor** Moquin-Tandon.

Helix neglecta var. *minor* Moquin-Tandon, Hist. Moll. France, ii, p. 251.
Helix neglecta var. *minor* Westerlund, Extram. Moll., 1878, p. 92.

The var. **minor** Moq. is described as "much smaller." The sub-var. *minor* Westl. is described as 8—9 mill. in diam., and 5—5½ mill. in alt.

BRITISH DISTRIBUTION.

West Kent—The shell in my possession from Luddesdown, near Cobham, scarcely exceeds the dimensions of the variety.

FOREIGN DISTRIBUTION.

France—On left bank of Paillon, Alpes Maritimes, Comm. Caziot; and Dupuy figures a specimen 9 mill. diam. from Grasse.

VARIATIONS IN COLOUR OF SHELL.

Var. **albina** Moquin-Tandon.

Helix neglecta var. *albina* Moquin-Tandon, Hist. Moll. France, 1855, vol. ii, p. 251.

The var. **albina** is described as "shell entirely white."

FOREIGN DISTRIBUTION.

France—This variety is recorded from Grasse, Alpes Maritimes, and Toulouse, Haute Garonne, by Moquin-Tandon; and from Montpellier, Hérault, by Dubrueil.

Var. **lutescens** Moquin-Tandon.

Helix neglecta var. *lutescens* Moquin-Tandon, Hist. Moll. France, 1855, vol. ii, p. 251.

The var. **lutescens** Moq. is described as of a "dull uniform yellowish tint."

FOREIGN DISTRIBUTION.

France—Recorded from Grasse, Alpes Maritimes, by Moquin-Tandon.

Var. **fuscescens** Moquin-Tandon.

Helix neglecta var. β Draparnaud, Hist. Moll., 1805, p. 108.
Helix neglecta var. *fuscescens* Moquin-Tandon, Hist. Moll. France, 1855, vol. ii, p. 251.

The var. **fuscescens** is described as being a brownish shell, with maculations above the periphery, and interrupted bands or white maculations beneath.

FOREIGN DISTRIBUTION.

France—Recorded from the Sorézois, Tarn, by Draparnaud.

VARIATIONS OF BANDING OF SHELL.

This section embraces the variations in number and also the different modes of their fusion and disruption.

Var. **vulgaris** Moquin-Tandon.

Helix neglecta var. *a* Draparnaud, Hist. Moll., 1805, p. 108, pl. 6, f. 12.
Helix neglecta var. *vulgaris* Moquin-Tandon, Hist. Moll. France, 1850, vol. ii, p. 250.

The var. **vulgaris** Moquin-Tandon, which represents the var. *a* of Draparnaud, is described as shell white, with one brown band above the periphery, with several fine and distinct or more or less confluent or interrupted brown bands beneath.

FOREIGN DISTRIBUTION.

France—The var. *a* is recorded by Draparnaud from Lauserte, Tarn et Garonne, where it was collected by Baron d'Audebard de Férussac.

The var. *vulgaris* is recorded by Moquin-Tandon from Grasse, Alpes Maritimes, and Toulouse, Haute Garonne.

Var. **bifrons** Moquin-Tandon, Hist. Moll., 1855, vol. ii, p. 250.

The var. **bifrons** is described as shell uniformly yellowish or whitish above, with brownish bandings below.

FOREIGN DISTRIBUTION.

France—The var. *bifrons* is recorded from Montpellier, Hérault, by Dubrueil.

VARIATIONS IN COLOUR OF BANDING.

Var. **ochroleuca** Moquin-Tandon.

Helix neglecta var. *ochroleuca* Moq-Tand., Hist. Moll. France, 1855, vol. ii, p. 251.

This variety is described as whitish, with a nankeen yellow or rufous band above the periphery and several of the same tint beneath, all more or less transparent.

FOREIGN DISTRIBUTION.

France—The var. *ochroleuca* is recorded by Moquin-Tandon from Grasse, Alpes Maritimes, and Toulouse, Haute Garonne.

Var. **papulosa** Moquin-Tandon.

Helix neglecta var. *papulosa* Moquin-Tandon, Hist. Moll. France, 1855, vol. ii, p. 251.

This variety is described as rufous-white, with two rows of irregular brownish spots above the periphery, and some indistinct or interrupted bands beneath, and is closely related to the var. γ of Draparnaud.

FOREIGN DISTRIBUTION.

France—The var. *papulosa* is recorded from Toulouse, Haute Garonne, by Moquin-Tandon.

Geographical Distribution.—The range of habitation of *X. neglecta* is probably, as yet, very imperfectly known and will not be elucidated with certainty until the internal structure of the animal inhabitant as well as those of its close allies have been fully examined.

Its distribution as far as known is chiefly through Southern and Central Europe, its apparent metropolis at present being South-Western France. The British record is far from any other known habitat of the species.

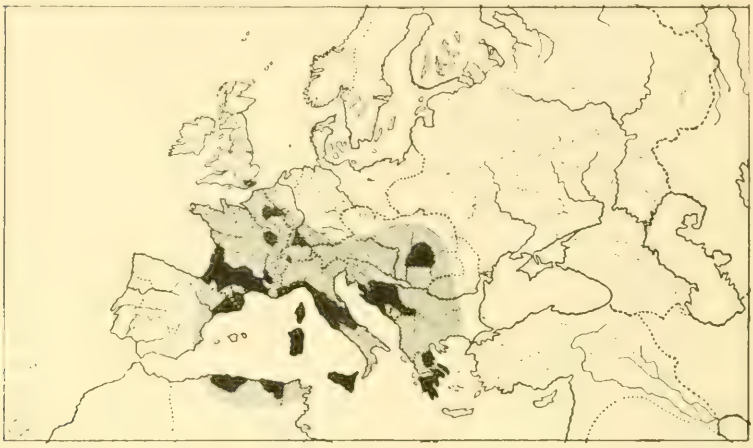


FIG. 216.—Geographical Distribution of *Xerophila neglecta* Drap.

BRITISH DISTRIBUTION.

Kent West—Luddesdown near Cobham, first found there in September 1915 ! by Mr. A. Santer Kennard.

FOREIGN DISTRIBUTION.

GERMANY.

This species has been reported from Damm, near Mosbach, Baden ; from Harz Mountains, Saxony ; from Nassau, and from Saalfield, East Prussia.

FRANCE.

Reported from the following provinces or departments, chiefly in the centre and south :—Alpes Maritimes, Aveyron, Basses Pyrénées, Bouches du Rhône, Drôme, Gard, Gironde, Haute Garonne, Hèrault, Lot et Garonne, Provence, Pyrénées Orientales, Rhône, Tarn, Tarn et Garonne, Var, and from Corsica.

SPAIN.

Reported from the east provinces and more precisely from Barcelona in Catalonia.

ITALY.

Reported from Abruzzi, Liguria, Romano, San Marino, Tuscany, Umbria, and the Isles of Sicily and Sardinia.

AUSTRO-HUNGARY.

Dalmatia—Recorded from Dalmatia by Schrockinger.

GREECE.

Reported from Peloponesus, Thessaly, Eubœa, and Cyclades.

RUSSIA.

Taurida—Retowski records *H. neglecta* for the Crimea.

ASIA-MINOR.

Syria—Recorded from Syria by Dr. J. E. Gray.

ALGERIA.

The var. *subneglecta* recorded from Bône and Algiers by Dr. Westerlund.

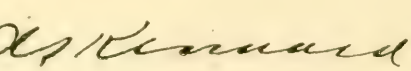


FIG. 217.—Autograph of Mr. A. Santer Kennard, the discoverer of *X. neglecta* in Kent.

Xerophila virgata (Da Costa).

1692 *Cochlea alba leviter umbilicata pluribus fasciis circumdata, clavicula productiore*, Lister, Hist. Conch., tab. 59, f. 56.
1702 *Cochleola alba fasciata Cantabrigiensis, umbilico parva*, Petiver, Gazoph., tab., 17, f. 6.

1778 *Cochlea* **virgata** Da Costa, Brit. Conch., p. 79, pl. iv, f. 7.
1777 *Helix zonaria* var., Pennant, Brit. Zool., iv, p. 138, pl. 85, f. 133A.
1799 — *lineata* Olivi, Zool. Adriat., p. 177.
1800 — *pisana* Dillwyn, Desc. Cat., p. 911.
1800 — *zonaria* Donovan, British Shells, vol. ii, p. 65.
1801 — *subalbida* Poiret, Coq. de l'Aisne, p. 83.
1803 — *virgata* Montagu, Test. Brit., vol. ii, p. 415, pl. 24, f. 1.
1805 — *variabilis* Draparnaud, Hist. Moll., p. 84, pl. v, ff. 11, 12.
1805 — *maritima* Draparnaud, op. cit., p. 85, pl. v, ff. 9, 10.
1830 — *monilifera* Menke, Syn. Moll., 2nd ed., p. 22.
1831 — *lauta* Lowe, Prim. Faun. Mader., p. 53, pl. v, f. 9.
1840 — (*Heliomanes*) *virgata* Gray's Turton, British Shells, p. 160, pl. iv, f. 31.
1855 — *burdigalensis* Grateloup, Catal., p. 5.
1857 — *luteata* Parreyss, Mal. Bl., p. 87.
1864 — *moesta* Bourguignat, Mal. Alger., vol. i, p. 227, pl. 25, f. 7.
1826 *Helicella variabilis* Risso, Hist. Nat. Europ. Merid., vol. iv., p. 71.
1837 **Xerophila** *variabilis* Held, Isis, p. 913.
1837 *Theba virgata* and *maritima* Beck, Index, pp. 12, 14.
1854 *Teba virgata* Leach, Synopsis, p. 68.
1892 *Xerolauta variabilis* Monterosato, Moll. isole adj. Sicilia, p. 23.
1892 *Xerovaria lineata* Monterosato, op. cit.
1892 *Xeromoesta moesta* Monterosato, op. cit.

Paul Pelseneer

HISTORY.—*Xerophila virgata* was first noticed and named polynomially by Dr. Martin Lister in 1692, while the first binomial designation was that bestowed by Da Costa, whose species is certainly not *Helix pisana* as stated by Moquin-Tandon.

It has been assumed that the present species may be the *Helix zonaria* of Linné, a view which was accepted by his eminent contemporaries Da Costa and Pennant.

I have pleasure in associating with the present species Prof. Paul Pelseneer, D.Sc., etc., of Brussels, Belgium, one of the very foremost of our truly scientific conchologists and the author of many valuable treatises upon the structure, development, and phylogeny of many molluscan groups.

There are eight undoubted specimens of *X. virgata* preserved in the Linnean Collection now in the possession of the Linnean Society of London, but no data exists in regard to them, and Mr. Sylvanus Hanley, who published a very exhaustive and excellent analysis of the shell collection of Linné, was apparently unaware of their presence in the cabinet.

This species is very variable in the size and shape of its shell, also in its ground colour, and in the disposition and colour of the banding, and has, therefore, been split up into a great number of species, most of which have no structural basis and very many are probably slight and quite unimportant modifications.

Dr. Pilsbry and others regard *X. variabilis* of Draparnaud as specifically distinct from *X. virgata* Da Costa, while others, including Moquin-Tandon, claim that the *Helix maritima* of Draparnaud is more or less entitled to separate acceptance. Dr. Pilsbry also considers that *H. burdigalensis* Grateloup, *H. grannonensis* and *H. lauteretina* of Bourguignat, *H. mendranoi* Servain, *H. salentina* Bl., and *H. striata* Brard should be regarded as synonyms.

Diagnosis.—Externally, *Xerophila virgata* differs from *Helix pisana*, with which it is frequently confused, by its smaller size, more prominent spire, wider umbilicus, and by the absence of the finely incised spiral lineation so characteristic of that species.

From *X. caperata* it differs by its shallow and irregular striation, so different from the distinct and more regular rib-like striæ of that species; it is also more globose in shape, and has a narrower umbilicus.

From *X. itala* it may be easily distinguished by its more globose shape and narrow umbilicus.

Internally, it differs from *H. pisana* by the complete freedom of the right tentacular retractor from the sexual complex, by the much simpler character of its gypsobelum or love-dart, and by the more numerous transverse ribs upon the mandible.

From *X. caperata* and *X. heripensis* it differs in its more bulky stylophore, which is sometimes cleft at the apex, as well as by the longer stem to the spermatheca, which has also a smaller terminal sac or vesicle.

From *X. itala* it is separated by having only one love-dart instead of the two found in that species.

Description of Shell.—Shell subglobose, spire somewhat raised and conical, base convexly rounded; of an opaque whitish or yellowish colour; rather solid and glossy, with fine but somewhat irregular striæ and a few scattered malleations. Whorls 5–6 in number, rounded at the periphery in adults, though sharply keeled in the young, and increasing gradually in size, but inflected on approaching the mouth, the whorls being separated by a distinct suture, and ornate with darker spiral banding, which typically consists of a broad zone above the periphery and seven more slender ones beneath as in Da Costa's figure. Umbilicus narrow but deep. Aperture obliquely lunate; peristome simple, with a thickened internal submarginal rib, which may be whitish or tinged with reddish-brown, and approaches most closely at the basal margin of the aperture, which is slightly dilated over the umbilicus. Diameter, 20 mill.; altitude, 8 mill.

The epiphragm is delicate, transparent, colourless and somewhat iridescent, with a small circumscribed opaque-white area, opposite the respiratory orifice, and formed by a dense deposit of calcareous particles. The epiphragm is attached basally close to the margin of the aperture, but the line of fixation gradually becomes more internal, until at the junction of the outer lip with the penultimate whorl it may be sunk 3–5 mill. within the aperture of the shell corresponding to the position of the internal rib.

The winter epiphragm is described as being often thicker, opaque, and whitish.

Description of Animal.—Numerous specimens collected in August, 1917, at Hunmanby, Yorkshire, by Mr. G. Fisher, had a somewhat elongate body, blunt in front, the tail keeled and tapering behind, and projecting well beyond the shell when crawling. The body was closely tuberculate, of a somewhat translucent greyish creamy-white, or even quite colourless behind and below the position of the tentacular retractors; the pigmentation, which varied from pale grey to

intense black, was thus limited to the muzzle and to the dorsal and sub-dorsal areas; the DORSAL GROOVES were indicated by a longitudinal mid-dorsal row of elongate pigmented tubercles, but there were no perceptible traces of the facial, lateral, or pedal grooves; the MANTLE was invariably intensely black with a violet tinge; the OMMATOPHORES were moderately long, colourless and transparent, and overspread with minute grey granulations, the retractors being more or less deeply pigmented and visible through the transparent skin and traceable along the sub-dorsum to their junction with the retractors of the anterior tentacles of their respective sides; the EYE-SPECKS are quite black and sub-apical, being less laterally directed than in certain other species; the ANTERIOR TENTACLES are comparatively long and similar in aspect to the ommatophores; the FOOT-SOLE is elongate, of an uniform creamy-white, and without perceptible longitudinal fasciation or division.

The average amount of manganese present in the tissues of *X. virgata* is stated by Prof. Boycott to be 0·001 per cent. of the total weight of the animal.

INTERNALLY, the organization is in general conformity with that of its allies, but the KIDNEY is very elongated and pointed at one end and has been likened to a scythe-blade.

FIG. 219.

FIG. 220.

FIG. 219.—Brain-ring or Nervous-centres of *X. virgata* Da Costa, greatly enlarged.

FIG. 220.—Heart of *X. virgata* var. *variabilis* Draparnaud, from Malta, × 3, showing auricle and ventricle within pericardium, and displaying the close relationship with the kidney.

The NERVOUS SYSTEM is largely concentrated in the NERVE-COLLAR or brain-ring, as in the normal Helicidian type, the cerebral pair are closely approximate and somewhat elongate, but not tumid, with thickened junction, which obscures the commissure; the cerebro-pedal and cerebro-visceral centres are stout and fairly elongate, pedal pair and visceral ganglia being fused into one mass, the pleural ganglia being indicated by a thickening of the connective cords and feeble pigmentation; the pedo-visceral complex is pierced by the aorta, while the buccal-bulb is protrusible beyond or can be drawn within the cerebro-pedal ganglia.

The REPRODUCTIVE ORGANS present a linguiform gelatinous ALBUMEN GLAND, of a greyish colour with a greenish tinge, the cæca of the OVOTESTIS are white and lobulate, the HERMAPHRODITE DUCT is attenuated at each end, but thickened medially; the VESICULA SEMINALIS dark grey, the blind end paler and spotted; the OVIDUCT sacculate, of a dull yellowish-grey or yellowish-brown; SPERM DUCT

FIG. 221.

FIG. 222.

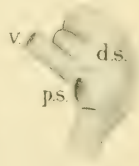


FIG. 223.

FIG. 221.—Stylophore or dart-sac of an adolescent example of *X. virgata* var. *variabilis* Drap., from Malta, showing its bifid distal end, × 4.

FIG. 222.—Vaginal mucus-glands of *X. virgata* var. *maritima*, from Corfe Castle, Dorset, × 3.

FIG. 223.—Stylophore of *X. virgata* var. *maritima*, from Corfe Castle, Dorset, showing the bifid summit of the stylophore, × 6.

d.s. stylophore or dart-sac; *p.s.* the severed end of penis-sheath; *v.* the severed vagina.

white and granular; SPERMATHECA usually subtriangular, but often elongate in shape, of a reddish-flesh colour, though occasionally whitish and slightly spotted; the stem or duct fairly long and stout, but thickened basally and without diverticulum. MUCUS GLANDS two on each side, each gland being variously divided into

2, 3, 4, 5 unequal terminal branches ; the PENIS SHEATH short and narrow, but dilated basally, separated by a distinct flexure from the long and fusiform more or less twisted and whitish EPIPHALLUS ; the FLAGELLUM is short and subulate ; the PENIAL RETRACTOR attached near the point of junction with the epiphallial tract.

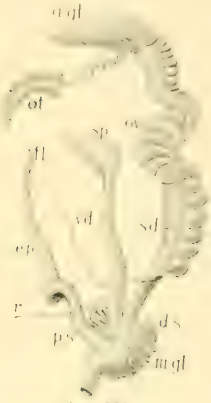


FIG. 224.

FIG. 225.

FIG. 226.

FIG. 224.—Reproductive system of *X. virgata* (Da Costa), Christchurch, Hants., × 2.
a.gl. albumen gland ; *d.s.* stylophore or dart-sac ; *ep.* epiphallus ; *fl.* flagellum ; *m.gl.* mucus glands ; *ot.* ovotestis continued as the hermaphrodite duct to the vesicula seminalis at its junction with the ovispermatoduct ; *ov.* oviduct ; *p.s.* penis-sheath ; *r.* penial retractor ; *s.d.* sperm-duct ; *sp.* spermatheca ; *v.d.* vas deferens.

FIG. 225.—Ovotestis and hermaphrodite duct, showing the cæcal arrangement, × 9.

FIG. 226.—Vesicula seminalis, showing its connection with the hermaphrodite duct and with the ovispermatoduct, × 9.

The STYLOPHORE or dart-sac is a large and broadly oval sac, fused throughout most of its length to the vagina ; it is yellowish-white in colour, and occasionally presenting the atavic feature of a notched or cleft apex, suggesting a probable mode of origin of the accessory sac from a degenerating dart sac.

Internally, the inner sheath of the sac tapers to an acute point, and the dart is difficult to dissect therefrom. In continental *X. variabilis* and *X. maritima* this bifurcation of the dart sac is much more frequently present than is usual in English specimens, but is by no means invariably found.

FIG. 227.

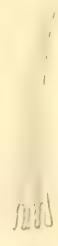


FIG. 228.

FIG. 229.

FIG. 230.

FIG. 231.

FIG. 227.—Reproductive organs of *X. variabilis* Drap. (after Schuberth).
FIG. 228.—Gypsobelum of *X. variabilis* Drap., greatly enlarged (after Schuberth).
FIG. 229.—Gypsobelum or Love-dart of *X. virgata* Da Costa, × 12.
FIG. 230.—Section through the apex of the Gypsobelum of *X. virgata* Da Costa, × 12.
FIG. 231.—Enlarged view of the flanged apex of the Gypsobelum, × 20.

The GYPSOBELUM or love-dart is from 2–3 mill. in length, and is the sole British representative of a peculiar type remarkable for its heavy shaft, which increases gradually from point to base, and furnished with two thin, transparent, simple edged, angulated blades, the angulation occurs near the apex, and from it the two

edges converge rapidly to the point. Below the angulation they gradually diminish and blend with the stem of the dart, about half-way down the weapon. In immature darts the blades only extend one-third or one-fourth the length of the dart, and at a still earlier stage no blades are visible. The shaft is usually marked transversely with coarse irregular bands or ridges, resembling lines of growth placed at irregular distances from each other, and varying in depth of whiteness. The base is the widest part of the shaft, but there is no abrupt expansion.

The figure from Schuberth of the gypsobelum of *Xerophila variabilis* shows a very different weapon, whose accuracy should be confirmed.

The SPERMATOPHORE resembles a spirally twisted filament of silk; it is about 18 mill. in length, and forms about two whorls with a row of upwardly directed marginal denticles on the anterior half, and is evidently moulded in the twisted epiphallus, the flagellum being too short to account for more than 2 or 3 mills. of

FIG. 232.

FIG. 233.

FIG. 232.—Spermatophore of *X. virgata*, showing its spirally twisted form, × 4.

FIG. 233.—Spermatheca of *X. virgata*, after conjugation, showing the distortion of the vesicle and its duct by the contained and rigidly spiral spermatophore, × 3.

its length. In drying the spiral part quickly hardens and distorts the spermatheca, and sometimes the duct or stem is also contorted by the slender, thread-like, coiled posterior end which hardens immediately when exposed to the air.

The ALIMENTARY SYSTEM is of the triodromous type, the ŒSOPHAGUS is long and encircled about midway of its length by the SALIVARY GLANDS, whose ducts are long, slender, and white; the CROP is elongate, usually brown in colour, and

FIG. 234.

FIG. 234.—Alimentary system of *X. virgata* Da Costa, showing the buccal bulb, salivary glands, salivary ducts, the triodromous type of gut, etc., × 3.

blends with the STOMACH, which terminates the œsophageal tract; the GUT forms the usual reversed S-like coil before entering the straight rectal tract.

The MANDIBLE or jaw is of a more or less crescentic shape, and of a fawn colour, the ends are rounded and thinner than the medial portion. It is about 1½–2 mill. wide, with 5 to 10 prominent transverse ribs, which are usually confined to the medial portion, the ends being generally smooth and free from ribbing, which

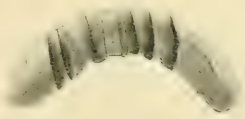


FIG. 235.

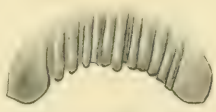


FIG. 236.

FIG. 235.—Mandible of *X. virgata*, from Chipstead, Surrey, prepared by Dr. E. W. Bowell, × 20.

FIG. 236.—Mandible or jaw of *X. virgata*, from Beverley, Yorkshire, prepared by Mr. J. Darker Butterell, showing narrower and more numerous transverse ribbings, × 18.

usually denticulate the upper and lower margins. Intermediate and slightly developed ribs are sometimes present on the jaws of the older animals, and in some the ribs only crenulate the lower or cutting margin. Moquin-Tandon describes the jaw of *H. variabilis* as bearing from 15–20 ribs, and that of *H. lineata* as having 7 to 9 only.

The RADULA is 2½ mill. long and 1½ mill. wide, of the usual type of ground snails, with ill-developed or absent endocones; the median row of teeth are tricuspid, the laterals are bicuspid, having only the mesocone and the ectocone, and this is

FIG. 237.—Representative teeth of the radula of *X. virgata* Da Costa, from Chipstead, Surrey, prepared and photographed by Dr. E. W. Bowell, × 360.
c. central or median series; *a.* admedian or lateral teeth; *m.* marginal teeth.

said to continue quite to the margin of the membrane, but speaking from my own observations of a few years ago, the marginals gradually become tricuspid by the acquirement of a third cusp due to the splitting of the ectocone.

The formula of a Chipstead specimen, prepared and photographed by Dr. E. W. Bowell, is

$$\frac{19}{2} \times \frac{11}{2} + \frac{1}{3} + \frac{11}{2} + \frac{19}{2} \times 120 = 7{,}320 \text{ teeth.}$$

Phylogeny and Ontogeny.—That the more primitive state of the *Xerophilæ* was possibly tetrabelous, and constituted by paired, double dart-sacs, is suggested by *X. itala* still retaining two sacs, though in a transitional semi-combined form, with a couple of darts still present therein.

In *X. virgata* the dart apparatus is normally reduced to the simple single sac and its contained dart, but we find that under special conditions or towards the limits of its geographical range there is apparently a distinct tendency to atavism, shown by the retention of a more or less definite bilobation, implying a former more complete separation of the sacs.

According to Moquin-Tandon, this bilobation is not unfrequently met with in the stunted and recessive var. *maritima* Drap. of the French coasts, and the same peculiarity was observed by the late Mr. C. Ashford in some specimens of the same variety from Corfe, Dorset. The same careful worker detected the similar atavic character in some *X. variabilis* from the Island of Malta; while specimens collected by Mr. J. Bliss, M.P., in December, 1920, at San Stefano, near Constantinople, and examined by Dr. E. W. Bowell, all showed the same retention of this primitive feature.

To further strengthen this hypothesis it would be desirable to compare the organization in this respect of other specimens of the species from remote localities, and dissections should also be made of adolescent animals in which indications of the former presence of double dart-sacs would probably be more frequently detected than in the mature mollusk.

Reproduction.—Though the preliminary coquetings leading up to conjugation have not been observed or published regarding this species, yet it is well established by many observations that the breeding season is during the late summer and autumn months, and that the male element is transferred in the form of a delicate, serrate and twisted spermatophore.

M. Bouchard-Chantereaux, who has so carefully studied the life-history of this and many other species, says that it breeds in September and October, but there are many reliable observations of pairing as early as August, and this process is continued up to October, and even November in this country.

The eggs are stated by Bouchard-Chantereaux and Gassies to be 40–80 in number, white, slightly transparent, more or less spherical in shape, and

varying from 1 mill. to 1½ mill. in diameter. They are deposited just beneath the surface of the soil in a trough excavated by the muzzle of the animal; they hatch in 15–20 days after deposition, the shells when hatched and for some two or three months afterwards are horn coloured. According to Gassies observations in the south of France, they become full grown at the end of the following year, but Bouchard-Chantereaux says that in the north of France they attain their full size during the second year, though reproducing their species towards the end of the first.

In their early and adolescent stages they differ from the adult in showing a distinct peripheral keel, which usually becomes obsolete before full growth is attained.

M. Gassies records the voluntary nuptials of *Helix pisana* and *Xerophila variabilis* during a period when the air was charged with electricity, the resultant progeny of the *H. pisana* being completely albine, while those of *X. variabilis* had deeply coloured shells, though the parent was of the usual fasciate variety.

Food.—In captivity Dr. Gain found this species to be more fastidious in its choice of foods than many others, as out of 98 different foods offered 58 were absolutely refused, while six others were only nibbled after two or three days starvation. Only four kinds of food—swede, radish-root, *Malva sylvestris*, and *Boletus edulis*—were greedily devoured, though ten others were freely eaten, and nineteen less freely.

In a state of nature it has been observed in this country to frequent or feed upon the ragwort (*Senecio jacobæa* L.), black knapweed (*Centaurea nigra* L.), yarrow (*Achillea millefolium* L.), sea thrift (*Statice maritima* Müll.), thistles (*Carduus* L.), hemlock (*Conium maculatum* L.), alexanders, etc.; while about Lyons, France, it has been noted by Dr. Riel as especially attached to *Arctium lappa* and *Onopordum acanthium* L.

Mr. Hargreaves has especially remarked on its noticeable preference for the decaying foliage of yarrow, ragwort, and alexanders (*Smyrnium olusatrum*), and that on the stems of thistles and hemlocks they are sometimes clustered as thickly as the *Helix pisana* at Tenby.

In Ireland Mr. R. Standen and others observed this species feeding upon the rabbit-droppings, which so thickly strew the sandhills, etc.

A carnivorous propensity has been recorded by Prof. R. Tate, who affirms its habit of feeding upon *Coccinellæ* and other small insects, while Mr. T. Vernon Wollaston has recorded that the present species in company with others were confined in the same receptacle with a number of beetles, which were all devoured in a fortnight's time, though green food was available.

Like the generality of species frequenting dry places, this species can endure long abstinence from food. Mr. A. Hartley has kept specimens in captivity entirely without food for fourteen months, and even this can probably be considerably exceeded.

Habits and Habitat.—This is an eminently gregarious species, usually seen in the daytime adhering in clusters to the stems and leaves of the different food plants, and, according to Staff-Surgeon Jones, are capable of withstanding a considerable amount of solar heat, far more than even *Helix pisana*; a continuance of dry hot weather will, however, compel it to seek shelter by self-burial at the roots of the plants until the advent of rain, when the snails suddenly appear in thousands, and have contributed to the belief in "showers of snails."

As a xerophilous species, it is remarkable as sharing with *Theba cantiana* and certain other species the habit, when roughly handled, of ejecting from its mouth one or two drops of a clear tasteless fluid like water.

Though not strictly geophilous, it seldom climbs so high on trees as those observed by Mr. L. E. Adams, which were at a height of ten feet or more up the trunks of the beech trees, and Mr. Hartley has observed them at Southport, where they climbed to the very top of the houses.

Its preference is for the short grass of the open downs, and it is most abundant on the sea-coast, and on limestone, chalky, or sandy soil, though far from being confined to them. Moquin-Tandon remarked upon the preference of *Helix maritima* for the coast, and apparently views this as indicating a different species, overlooking that this habitat may be a cause of the variation.

Dr. Riel, of Lyons, has recently investigated the analogy between halophile areas and waste or arid ground far removed from the influence of the ocean, and shows that the characteristic plants are similar in both these different areas; while the non-marine mollusca, naturally accustomed to live under maritime influence, are demonstrated to prosper admirably when transferred to waste ground far removed from the sea.

They are not very active, but fairly bold, but do not usually extend the anterior parts very far beyond the shell when crawling. One specimen while under observation crawled $1\frac{1}{2}$ inches in one minute, or a mile in 29 days 8 hours.

It is said to be very sensitive and averse to wind, and can only be found during windy weather with great difficulty, while very persistent drought or consistent heavy rains are almost equally inimical.

Hibernation.—In this country *X. virgata* usually does occupy hibernating quarters, although isolated instances of its hardihood are recorded, and the habit of hibernation is not accepted by some observers.

It has been stated to be very late in waking from its winter dormancy, and Mr. J. A. Hargreaves from his long experience of this species at Scarborough, affirms that it is never obtainable until the approach of summer, and sometimes is even as late as August. It is, however, probable that the growing young are about, and that July and August are the periods of their approach to full size, while the older ones in a great measure have died off during the winter months.

During hibernation it has the habit of burying itself mouth upwards level with the soil, exactly as other species do, but it is easily revived by warmer spells, and then moves about in search of food.

Uses.—*X. virgata* is regarded as edible in certain parts of France and in other countries. A large form is, according to Mr. L. E. Adams, always to be found on sale in the Algerian markets. The var. *variabilis* is very generally eaten by the peasantry at Montpellier, and throughout the ancient province of Aquitaine, and the var. *lineata* in other parts of France.

Parasites and Enemies.—This species has many enemies amongst the birds, which evidently regard it as a desirable food. The rock dove (*Columba livia*), the stock dove (*Columba œnas* L.), and pigeons generally eat this species freely. The peewit (*Vanella cristata*), the wheatear (*Saxicola œnanthe* L.), and pheasants also find it nutritious. The fieldfare and redwing search during the winter months for and feed upon *X. virgata*, and the starling will also eat them, especially in winter,

It is found, though not abundantly, at "thrush stones," indicating it as occasionally eaten by the thrushes, as it is by blackbirds also.

Perhaps the sheep are the greatest destroyers of this species, which is said to be sought for by them, as the sheep have been noticed to frequent and graze at those places where the shells are most plentiful; this diet is believed to give to the South Down mutton its peculiar and prized flavour.

Mice are also stated to make it an article of food at Northampton, according to Mr. C. E. Wright.

Melindæ, a group of flat-bodied, blue dipterous flies which in their larval stage are recorded as parasitic upon, devouring and eventually destroying *X. virgata* and other species.

M. cognata Robineau-Desvoidy, which is common about Cambridge, deposits its eggs from May to August, in or near the respiratory orifice of *X. virgata*, to which species it is apparently restricted, as *H. hortensis*, *X. itala*, and other species, plentiful around, were not infested. The larvæ on hatching bore into the kidney, feeding upon its substance and juices, and afterwards devouring the liver and other organs. Before the larva is full grown, the snail dies, becomes a decomposing liquid mass, and forms the final meal of the larva, after which it forsakes the shell of its victim, and burrows in the earth to pupate, the fly emerging in about a fortnight, the whole life cycle occupying about a month.

Other larvæ of the same species (or of *M. gentilis* Robineau-Desvoidy, an allied species, which have been obtained by Dr. E. W. Bowell from *X. virgata*) may for a time exist in the same shell, but they are eventually destroyed and fed upon by the survivor, as only one larvæ attains maturity in each shell.

The *Melindæ* larvæ are, however, themselves liable to be destroyed not only by the larvæ of certain Ichneumon flies, which are especially parasitic upon them, but also by the sarcophagous and possibly saprophagous larvæ of *Sarcophaga crassimargo* Pand, a dipteron which Dr. Keilen believes invades and devours the remains of any snail which has been previously parasitized and killed by the *Melindæ*.

Geological Distribution.—The maps showing the fossil distribution of this species as known to me, will show how few are the observations that have been made upon this aspect of the subject, and will certainly emphasize the desirability of caution in drawing any final conclusions from such scattered data, if at all conflicting with the more numerous and palpable evidences presented by geographical distribution.

It has been remarked by Kennard and Woodward that the large coarsely striated form of *X. virgata* prevailing in the south-east of England and on the opposite continental coast is quite unrepresented in Ireland, the recent shells as well as those of the Irish deposits being identical with those of the west of England.

ENGLAND.

Pleistocene.—In Kent East, it is recorded from the fluviatile deposits at Faversham by Prof. Morris.

In Essex South, it is cited from the drift in Sam Green's pit, Ilford, by Mr. J. P. Johnson; and is also recorded from the freshwater marls of Clacton.

In Cambridge, it is recorded from the drift at Barnwell by Mr. Johnson, and as common in the gravels at Barrington near Cambridge by Mrs. McKenny Hughes.

In Worcester, it is recorded from the freshwater deposits of Cropthorne near Pershore by Prof. Morris.

FOREIGN DISTRIBUTION.

In **France,** *Helix variabilis-antiqua* is reported from beds in the Mediterranean basin by M. de Serres, and this species or "an analogous fossil" from the deposit at Dax, Landes, by M. Grateloup; while Dr. Paul Fischer has recorded it from the bone-breccia bed of the cavern of Bagnères de Bigorre, Hautes Pyrénées; Caziot and Maury report *H. maritima* var. *fabroniana* from the Valley of the Var, Alpes Maritimes; and M. Caziot also records it from the Upper Pleistocene bone-breccia at Toga near Bastia, Corsica.

In **Italy,** *H. variabilis* is recorded from Post-Pliocene Travertin at Colle, Staggia, and Chiusdino near Siena in Tuscany by Dr. Pantanelli.

In **Algeria,** *X. variabilis* is recorded by M. Bourguignat as fossil about Calle, also at Cap de Garde, near Bône, and on the island of Rachgoum at the mouth of the river Tafna.

ENGLAND.

Holocene.—In West Cornwall, it is recorded by Rev. R. A. Bullen from the stratified sand at a depth of 4–7 feet below the lacustral deposit at Perranzabuloe. Collected in blown sand on Towan Head by Kennard and Warren; from Riviere Towan near Camborne, and also from an ancient kitchen-midden, with broken marine-shells, in an old gravel-pit, at Hayle, by Mr. Johnson; while Mr. W. D. Roebuck found it abundantly in the cliffs west of Lizard Point.

In North Devon, the var. *submaritima* of Jeffreys was found in the raised beach at Taunton by F. J. Partridge.

In North Somerset, it has been found by Mr. Swanton in a holocene deposit on Brean Down, Weston-super-Mare.

In Dorset, it has been found in the ejecta of mole-hills and rabbit-warrens on downs above Durdle Barndoor and behind Swyre-head by Rev. R. Ashington Bullen.

In North Wilts., the type form and var. *albicans* found in superficial deposits at Avebury by Mr. H. St. George Gray.

In East Sussex, it has been found in a Neolithic hill-wash, Brighton, by Mr. Johnson; and by Rev. S. Spencer Pearce in a holocene deposit at Cow-Gap Cliff, Beachy Head, Eastbourne.

In the Isle of Wight, it was found in subærial beds, and in a Neolithic rain-wash at St. Catherine's Down by Bristow and Kennard and Warren.

In East Kent, it has been collected from a deposit overlying the rubble-drift at Barton Court, Buckland, Dover, by the Rev. R. Ashington Bullen.

In Lincoln North, it was found at Greetwell in 1906 by Mr. J. F. Musham.

In South-west Yorkshire, it was discovered by Dr. Corbett in the deposit of lacustrine marl at Askern near Doncaster.

IRELAND.

In West Galway, it was found in the "black band" of the celebrated deposit at Dogs' Bay, Roundstone, by Mr. R. D. Darbishire.

FOREIGN DISTRIBUTION.

In **Spain,** the Rev. R. Ashington Bullen records from the Island of Majorca, *Helix variabilis* and var. *maritima* from a hill-wash at Porto Pi near Palma; and the var. *maritima* in coast deposits at Alcudia.

The same author also records *Helix virgata* and var. *maritima* in a deposit near the railway bridge at Manresa near Barcelona, Catalonia.

In **Algeria,** *X. variabibis* is recorded by M. Bourguignat from the recent limestones at Fouka, and about "Fort de l'Eau" near Alger, as well as in the modern deposits near Koléa and Tipaza.

Variation.—More than 150 varieties of this species are catalogued, but amongst these, there are certainly many exact duplications or synonyms and numerous others which are approximately identical, but authentically named specimens are difficult to obtain.

Many scientists who cultivate the study of the Xerophiles in France regard as species numerous shells which exhibit far less differences than British conchologists consider necessary to entitle them to specific status, and, furthermore, the structural peculiarities of the animal, if any, are in the majority of cases, quite unknown and disregarded.

The most satisfactory method to adopt in this group until structural differences have been demonstrated, would be to regard very closely related shells as simple varieties of the older forms around which they cluster; this course would keep prominent the relationship, while emphasizing the differences, when these are not in themselves sufficiently striking to absolutely warrant elevation to specific rank.

The effects of a different environment is often strikingly displayed in the shell. The uniformly dull white shell is induced by continued exposure to ardent sunlight on dry and arid ground, such shells are regarded as essentially characteristic of hot desert regions, the thick whitish shell reflecting the heat to which it is exposed, and therefore tending to more effectually conserve the essential moisture of the animal inhabitant.

Pigmentation attains its extreme development in the var. *nigrescens*, in which the whole surface of the shell is very dark and more largely composed of animal matter. In its most characteristic state it may easily be mistaken for *Hygromia hispida*. This form is connected with the dull white form by the varieties *rufula*, *lutescens*, etc.

VARIATIONS IN FORM OF SHELL.

Var. **conica** Germain.

Helix pilula var. *conica* Germain, Feuille jeunes Nat., p. 102.
Helix variabilis vars. E. F, and D (in part), Gassies, Moll. Agenais, 1849, p. 79.
Helix lineata var. *major* Bourguignat, Mal. Alger., 1864, vol. i, p. 219, pl. 24, f. 30.

Shell very conical in shape. Well marked shells of this variety have an altitude quite equal to or even exceeding their diameter.

The var. **conica** is described as being as broad as high, very markedly conical, quite convex below, suture somewhat deep. Diam., 10 mill. ; alt., 9 mill.

The sub-var. **major** Bourguignat. The type figure is very conoid and shows a diameter and altitude of 15 mill.

Fig. 238—*X. virgata* var. *conica* Germain (*H. lineata* var. *major* Bourguignat). Algiers (after Bourg.).

The var. E of Gassies is very conical, but zoned as in the typical *X. variabilis*. The var. F of Gassies is also very conical, of a fawn or yellowish-grey in colour with an interrupted paler keel-line. The var. D of Gassies is described as "conical, white, peristome very thick." The very thick peristome, as well as the character of the pigmentation, are, however, characters not necessarily correlate with form variation.

BRITISH DISTRIBUTION.

This variety is not common, but widely dispersed.

In **England**, it has been noted at Weston-super-Mare, Somerset, by Mr. J. Madison ; at Bridport, Dorset, by Mr. Deakin ; at Blaxhall, Suffolk, by Mr. G. T. Rope ; and at Dymchurch, Kent, and Filey, Yorkshire, by Mr. W. E. Brady.

In **Wales**, it has been found at Rhyl, Flintshire, by Mr. W. H. Boland ; at Colwyn Bay, Denbigh, by Mr. Brady ; and at South Cliff, Tenby, Pembrokeshire, by Mr. A. G. Stubbs.

In **Ireland**, it was collected by Mr. P. H. Grierson at Barmeath, Louth, and Ennistymon, Clare ; and by Mr. A. W. Stelfox at Earawalla Point and Dogs Bay, Galway, the latter very characteristic specimens.

FOREIGN DISTRIBUTION.

In **France**, Dr. Gassies has found the varieties he describes in the Agenais, but especially notes the var. F as found on a bank of lacustrine marl of 3rd century age at St. Julien de Fargues, Landes ; and the var. *conica* Germain is recorded as rare at Puy, near Dieppe, Seine Inférieure.

In **Algeria**, M. Bourguignat records his *H. lineata* var. *major* from Alger.

Var. **subglobosa** Jeffreys.

Helix virgata var. *subglobosa* Jeffreys, Brit. Conch., 1862, vol. i, p. 210 (pars).
Helix virgata var. *inflata* Westerlund, Faunen Palæarct., 1889, p. 166.
Helix virgata var. *variabilis* f. *turgida* Blanc. and Westl., Westerlund, op. cit.
Helix virgata var. *variabilis* f. *tumida* Westerlund, in Kobelt's Rossm. Icon., 1877, vol. v, f. 1299.
Helix virgata var. *variabilis* f. *variata* Westerlund, Faunen Palæarct., 1889, p. 166.
Helix virgata var. *dilatata* Sikes, mss.

The var. **subglobosa** is more globose, last whorl larger in proportion to the rest.

Dr. Jeffreys included in his description of this variety the not necessarily correlated characters of "smaller, with a double band above the periphery," which I have excluded.

The sub-var. **inflata** Westerlund has a greatly swollen and variously banded shell, with a red-brown submarginal rib. Diam., 20–22 mill. ; alt., 14–15 mill.

The sub-var. **turgida** Bl. and Westl., is described in exactly the same terms as var. *inflata*, except that the peristome is stated to be light-brown and the inner marginal rib whitish. Diam., 20 mill. ; alt., 13 mill.

Fig. 239.

Fig. 240.

Fig. 241.

Fig. 239.—*X. virgata* var. *tumida* Westerlund, Bari, Apulia, Italy (after Kobelt).
Fig. 240.—*X. virgata* var. *dilatata* Sikes ms. (reduced), Appledore, Kent, Rev. C. T. Cribb.
Fig. 241.—*X. virgata* var. *inflata* Westerlund, Taranto, Apulia, Italy (after Kobelt).

The sub-var. **tumida** Westerlund is a very large form, but is similarly characterized by its shape, but has somewhat radiate zigzag markings, and a bright lilac aperture ; the lip is broad and red-brown in colour. Diam., 30 mill.; alt., 22–23 mill.

The sub-var. **variata** Westerlund (which is synonymous with *H. variabilis* var. *turbinata* of Calici) has the penultimate and body-whorl much swollen and rapidly increasing in size ; the body-whorl being tumidly rounded. Diam., 18–20 mill. ; alt., 15–20 mill.

The sub-var. **dilatata** Sikes mss. has the last whorl more dilated, the base more convex, the umbilicus somewhat larger, and the aperture less oblique and loftier than in type shells.

BRITISH DISTRIBUTION.

England—The var. *subglobosa* Jeffreys is recorded by its author from St. Mawes, near Falmouth, Cornwall ; by Miss Hele from the sandhills, Weston-super-Mare, North Somerset ; from the vicinity of Swanage, Dorset, by Mr. William E. Brady ; from Winchester Downs, Hampshire, by Mr. J. R. le B. Tomlin ; from Folkestone, East Kent, by Mrs. Fitzgerald ; from Charing, West Kent, by Canon Horsley ; from Lowestoft, Suffolk, by Mr. J. E. Mayfield ; from Cooper's Hill, Gloucester, by Mr. E. Simpson ; and from Durdham Downs, Bristol, by Mr. J. W. Cundall.

The sub-var. *dilatata* has been found in April, 1899, at Broadstairs, Kent, by Mr. F. H. Sikes ; and at Appledore, Kent, by Rev. C. T. Cribb.

Wales—Reported from Pembroke at Penally and Black Rock, Tenby, and from Flintshire at Voryd, Rhyl, by Mr. G. S. Tye.

Ireland—Recorded by Dr. Jeffreys from Bantry Bay, Kerry.

FOREIGN DISTRIBUTION.

Italy—The sub-var. *inflata* is recorded from Italy at Taranto, Apulia, by Dr. Kobelt ; and was collected by Mr. F. H. Sikes at Pompeii in 1909.

The sub-var. *tumida* is recorded and figured from Bari, Apulia, by Dr. Kobelt.

The sub-var. *turgida* is recorded from South Italy.

The sub-var. *variata* is cited by Dr. Kobelt from Calatafimi and Messina, Sicily.

Var. **depressa** Requien.

Helix variabilis var. *depressa* Requien, Catal. Corse, 1848, p. 15.
Helix variabilis var. B, C, and G Gassies, Moll. Agenais, 1849, p. 79.
Helix virgata var. *subaperta* Jeffreys, Brit Conch., 1862, vol. i, p. 210.
Helix variabilis var. *depressa* Bourg., Mal. Alger., 1864, vol. i, p. 226, pl. 36, ff. 7–9.
Helix virgata var. *variabilis* f. *depressa* Westl., Faun. Palæarct., 1889, p. 166.
Helix lauta Lowe, Prim. faun. Mader., 1831, p. 53, pl. v, f. 575.
Helix cyzicensis v. *durtalensis* Germain, Moll. Maine-et-Loire, 1903, i, p. 121, pl. 2, ff. 1, 2.
Helix variabilis var. *durtalensis* Germain, op. cit., 1904, p. 95, pl. ii, ff. 1. 2.

Shell depressed.

The var. **depressa** of Requien is a descriptive name. The sub-var. *depressa* of Bourguignat is described as of moderate size with a depressed spire and a diameter of 16–17 mill. and an altitude of 12–13 mill. The sub-var. *depressa* of Westerlund is depressed or quite flat, umbilicus wider and less overspread by the reflected lip ; size variable, the ratio of altitude being about two-thirds of the diameter.

The var. B of Gassies is said to be more discoid than type ; the var. C is discoid and greyish ; and var. G is described as depressed, etc.

The sub-var. **lauta** is globosely depressed. Diam., 14–18 mill. ; alt., 9–13 mill.

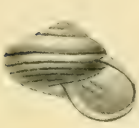


Fig. 212.

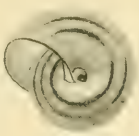


Fig. 213.

Fig. 214.

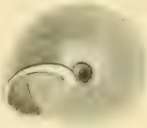


Fig. 215.

Fig. 212, 213.—*H. virgata* var. *depressa* Requien (*H. lauta* Bourguignat), Algiers (after Bourgt.).
Fig. 214, 215.—*H. virgata* var. *durtalensis* Germain, Durtal, Maine et Loire, France (after Germain).

The var. **subaperta** Jeffreys has a more depressed spire and a wider umbilicus, and is regarded by its author as allied to the *Helix neglecta* of Draparnaud.

The sub-var. **durtalensis** is described by Dr. Germain as a large depressed form, and is also constituted a var. *major* of *H. cyzicensis*. Diam., 17–18 mill. ; alt., 13–14 mill.

BRITISH DISTRIBUTION.

England—The var. *depressa* is recorded from Barnstaple, Devon, by Mr. F. J. Partridge ; from Swarraton, Hampshire, by Rev. W. L. W. Eyre ; from Carisbrook, Isle of Wight, by Mr. G. K. Gude ; from Oxford by Mr. A. H. Jowett-Murray ; from Tenby, Pembrokeshire, by Miss F. M. Hele ; from Canwick, Lincoln, by Mr. J. F. Musham ; this last specimen was 18 mill. in diameter and 10 mill. in altitude, and had the markings ascribed to var. *picturata*.

The sub-var. *subaperta* is recorded by Dr. Jeffreys from Bath, Somersetshire ; from the Downs, near Winchester, by Mr. J. R. le B. Tomlin ; at Folkestone, Kent, by Mrs. Fitzgerald ; at Ambrosden, Oxford, by Mr. Lionel E. Adams ; and by Mr. J. Blackburn, at Boston Spa, Yorkshire, in Sept. 1886.

Wales—Mr. F. W. Wotton has found var. *depressa* on East Moors, Cardiff.

FOREIGN DISTRIBUTION.

France—It is recorded from the environs of Paris by M. Pascal ; from Bordeaux, Gironde, by Dr. Scharff ; reported from Nice, Alpes Maritimes, by Prof. T. D. A. Cockerell ; and by Requien for several places in Corsica.

The sub-vars. B, C and G are all reported from the Agenais by Dr. Gassies.

The sub-var. *lauta* Lowe is found on all the oceanic and Mediterranean shores of Western Europe, and was originally described from Madeiran specimens, and has been noted in France from the Aisne, Bouches-du-Rhône, Gard, Var, and Vaucluse.

The sub-var. *durtalensis* is recorded by Dr. Germain from Durtal near Angers, Maine-et-Loire, and from Rochelle, Charente Inférieure.

Spain—The sub-var. *lauta* is recorded from Alcudia, Island of Majorca, by the Rev. R. Ashington Bullen.

Var. **carinata** Jeffreys.

Helix virgata var. *carinata* Jeffreys, Brit. Conch., 1862, vol. i, p. 210.
Helix variabilis var. *carinata* Pirona, Moll. Friuli, 1865, p. 13.
Helix variabilis v. *subcarinata* Moq.-Tand., Hist. Moll., vol ii, p. 263, pl. 19, ff. 25-26.
Helix lineata var. *subcarinata* Bourguignat, Mal. Alger., 1864, vol. i, p. 220.
Helix obsoleta Ziegler, Pfeiffer, Mon. Helic. Viv., 1848, vol. i, p. 158
Helix lineata var. I, de L'Hôpital, Moll. Caen, 1889, p. 22.

The var. **carinata** Jeffreys is described as "compressed above, periphery strongly keeled," adding the subsidiary character "shell yellowish-white," which is not an essentially correlate feature. The var. *carinata* Pirona has the "last whorl acutely carinate."

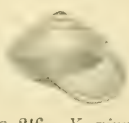


Fig. 216.—*V. virgata* var. *carinata* Jeffreys. Yarmouth, I. of Wight. Mr. C. Ashford.

The sub-var. **subcarinata** Moq. is described as last whorl flatter, and subcarinate ; the var. *subcarinata* Bourgt. has an obsolete keel on the last whorl, which disappears at the aperture ; the var. *H. lineata* var. I de L'Hôpital has a more risen spire, is of a white colour, and the last whorl often subcarinate.

The sub-var. **obsoleta** Ziegler is described by Pfeiffer as small and white, with a blunt keel, and may be doubtfully placed under this head. It is the *H. virgata* var. γ of Dr. Pfeiffer.

The specimens upon which Dr. Jeffreys founded the variety were found at Winfrith [erroneously spelt Wingfrith by Dr. Jeffreys] near Wareham, Dorset, by Mr. J. E. Daniels, of Epsom, about 1855, who, writing in Nov. 1875. says :—"It is now upwards of twenty years since I found them. I should rather have called them 'subcarinate'; nevertheless, the keel was well marked, and the variety was entirely confined to one bank a few yards long."

BRITISH DISTRIBUTION.

England—It has since been noted at Bratton St. Maur, Somerset, by Mr. E.W. Swanton ; at Yarmouth, Isle of Wight, by Mr. C. Ashford ; at Folkestone, Kent, by Mrs. Fitzgerald ; at Eastbourne, Sussex, by the Rev. S. Spencer Pearce ; at Thorpe, Norfolk, and Lowestoft and Mendlesham, Suffolk, by Mr. A. Mayfield ; at Islip, Oxon, by Mr. A. H. Jowett-Murray ; in Yorkshire, at Bridlington, by Mr. W. E. Brady, at Pontefract, by Mr. J. Wilcock, and Bank-Field, Cottingley, by Mr. J. W. Carter.

FOREIGN DISTRIBUTION.

France—Moquin-Tandon quotes the var. *subcarinata* as living on the French and Corsican coasts, and especially cites Port Vendres in Pyrénées Orientales. Pascal cites var. *subcarinata* from about Paris.

The *H. lineata* var. I of de L'Hôpital is cited for Ste Paix near Caen in the department of Calvados by its author.

Italy—Var. *carinata* Pirona is recorded from Udine, Venetia, by its author.

Algeria—The var. *lineata-subcarinata* Bourguignat is recorded from Bône and Oran by Bourguignat.

VARIATION IN SCULPTURE OF SHELL.

Var. **striatula** Bourguignat.

Helix lineata var. *striatula* Bourguignat, Mal. Alger., 1864, vol. i, p. 220.

SHELL with stronger and better-marked transverse striæ, approaching certain varieties of *Helix submeridionalis*.

It is not improbable that this form may, on a critical examination of its structure, prove to be a distinct species; it approximates to specimens named *H. nilssoniana*.

BRITISH DISTRIBUTION.

Sussex E.—A distinctly and regularly striate shell resembling *X. caperata* found at Rye by the Rev. S. Spencer Pearce.

FOREIGN DISTRIBUTION.

France—Ax, Ariège, July 1887 ! Dr. W. E. Clarke.

Algeria—Recorded from Bône by Bourguignat.

VARIATION IN SUBSTANCE OF SHELL.

Var. **crassilabrum** Bourguignat.

Helix lauta var. *crassilabrum* Bourgt., Mal. Alger., 1864, vol. i, p. 222.
Helix variabilis var. D, Gassies, Moll. Agenais, 1849, p. 79.

SHELL with the peristome greatly thickened by the extension and development of the submarginal rib, which may be white, rosy, or fawn-coloured. As subsidiary characters, it is noted that the shell is usually small and of an uniform whitish tint.

The *H. variabilis* var. D of Gassies is described as "conical, white, peristome very thick."

BRITISH DISTRIBUTION.

It has not yet been recorded for the British Isles.

FOREIGN DISTRIBUTION.

France—The var. D of Gassies is recorded from the Agenais by its author.

Algiers—The var. *crassilabrum* is recorded from the environs of Bône by M. Bourguignat.

Var. **pellucens** Shuttleworth.

Helix pellucens Shuttleworth in coll. Blauner.
Helix pellucens Requien, Coq. Corse, 1848, p. 46.
Helix variabilis var. *pellucens* Moq.-Tand., Hist. Moll., 1855, vol. ii, p. 263, pl. xix.

SHELL extremely thin and subtransparent.

BRITISH DISTRIBUTION.

Isle of Wight—Freshwater, 1886 ! J. W. Wood.

Pembroke—Giltar near Tenby, 1895 ! A. G. Stubbs.

FOREIGN DISTRIBUTION.

Corsica—Recorded by Moquin-Tandon for Biguglia near Bastia, St. Florent, and Bonifacio.

VARIATIONS IN SIZE OF SHELL.

Var. **variabilis** Draparnaud.

Helix variabilis Draparnaud, Hist. Moll., 1805, p. 84, pl. v, ff. 11, 12.
Helix lineata var. 2 *variabilis* de l'Hopital, Moll. Caen, 1859, p. 22.
Helix lauta var. *maxima* Bourgt., Mal. Alger., 1864, vol. i, p. 222, pl. 23, ff. 12 14.
Helix lineata var. *maxima* Bourgt., Mal. Alger., 1864, vol. i, p. 219.
Helix variabilis var. *major* Pirona, Moll. Udine, 1865, p. 13.
Helix virgata var. *variabilis* Westerlund, Faun. Palæarct., 1899, p. 166.
Helix virgata var. *inflata* Westerlund, Faun. Palæarct, 1889, p. 166.
Helix virgata var. *variabilis* f. *tumida* Westl., op. cit., Rossm. Icon., 1877, vol. v, f. 1299.
Helix virgata var. *major* Taylor, Journ. of Conch., 1883, p. 29.
Helix variabilis var. J Gassies, Moll. Agenais, 1849, p. 79.

Shell larger, attaining 20 mill. or more.

The var. **variabilis** Drap. is figured by its author as about 20 mill. in diameter. The sub-var. *virgata-variabilis* Westerlund is described as 20 mill. in diameter, and 14–15 mill. in alt. The sub-var. *lineata-variabilis* de l'Hôpital is depressed, with a larger umbilicus. Diam., 20 mill. ; alt., 10 mill.

The sub-var. **lauta-maxima** Bourguignat is described as usually whitish, but frequently banded ; diam., 23 mill. ; alt., 18 mill. The sub-var. *lineata-maxima* Bourgt. is 19 mill. diam., and 16 mill. alt.

Fig. 247.

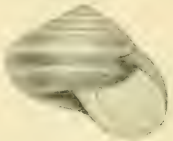


Fig. 248.

Fig. 247.—*X. variabilis* Drap. (*Helix variabilis* Drap.), after Draparnaud.
Fig. 248.—*X. virgata* var. *maxima* Bourgt. (*H. lauta* var. *maxima*), after Bourguignat.

The sub-var. **major** of Pirona is 18–20 mill. diam., and 14–16 mill. alt. The sub-var. *virgata-major* Taylor is described as 20 mill. in diam.

[The *Helix lineata* var. *major* Bourguignat is a very conoid, medium-sized shell, which I include under var. *conica*].

The sub-var. *inflata* Westerlund is described as 20–22 mill. in diameter.

The sub-var. *tumida* Westerlund is described as 30 mill. in diameter.

The sub-var. *turgida* Blanc and Westerlund is described as 20 mill. in diameter.

BRITISH DISTRIBUTION.

England—The variety is recorded from several counties mainly in the south and west of England, the largest British specimen known was found by the Rev. S. Spencer Pearce in cultivated fields at Holywell Cliffs, Eastbourne, Sussex, and measured fully 25 mill. in diameter. In Dorset, the late Mr. Clement Reid found shells ⅛ths of an inch wide at Affpuddle ; the late Mr. J. C. Mansel-Pleydell collected similar specimens at Puncknowle ; Dr. Jeffreys records that the largest shells of this species seen by him were collected by Mr. W. Thompson near Weymouth ; and Rev. Canon Norman found very large shells in the Isle of Portland. In East Kent, Rev. Canon Horsley has collected very fine examples at Margate; and Mr. L. E. Adams has recorded finding shells 20 mill. in diameter in stubble-fields near Lydden. Specimens of similar size have been found in several other areas.

FOREIGN DISTRIBUTION.

France—The "large variety" of *H. variabilis* has been found in the Alpes Maritimes at Nice, by Col. Wilmer, and at Monaco by Dr. Viner ; the var. J in the Agenais by Dr. Gassies ; and the *H. lineata* var. *variabilis* is recorded from Caen, Calvados, by de l'Hôpital.

Italy—The var. *major* Pirona is from Friuli, Venetia, and the sub-var. *tumida* Westerlund from Bari, Apulia, if correctly assigned to this species, are the largest specimens known. Signor Mascarini records a specimen 26 mill. by 19 mill. from S. Elpidio and Fermo in the Marches. The sub-var. *inflata* is recorded from Taranto, Apulia, by Dr. Kobelt, and from Pompeii, Campania, by Mr. F. H. Sikes. The sub-var. *turgida* is from Southern Italy, and is also recorded by Dr. Kobelt.

Algeria—M. Bourguignat records *H. lauta-maxima* from Bône, Province of Constantine, and *H. lineata-maxima* from Hussein Dey near Alger, and Mansourah near Tlemcen.

Dalmatia—Herr Clessin records specimens from Zara, 20 mill. in diameter.

Var. **maritima** Draparnaud.

Helix lineata Olivi, Zool. Adriat., 1799, p. 177.
Helix maritima Drap., Hist. Moll., 1805, p. 85, pl. v, ff. 9, 10.
Helix burdigalensis Grateloup, Catal., 1855, p. 5.
Helix lineata var. *minor* Bourguignat, Mal. Alger., 1864, vol. i, p. 220.
Helix lauta var. *minor* Bourguignat, op. cit., p. 222, pl. 23, ff. 20—22.
Helix moesta var. *minor* Bourguignat, op. cit., p. 229.
Helix variabilis var. *minor* Bourguignat, op. cit., p. 226, pl. 23, ff. 10, 11.
Helix variabilis var. *minor* Pirona, Moll. Udine, 1865, p. 13.
Helix virgata var. *submaritima* Jeffreys, Brit. Conch., 1862, vol. i, p. 210.
Helix virgata var. *minor* Taylor, Journ. of Conch., 1883, vol. iv, p. 29.
Xerovaria lineata Monterosato, Moll. Isole adj. Sicilia, 1892, p. 23.

Shell much smaller than typical form, and usually with a more elevated spire, and more deeply pigmented bands.

The original description by Draparnaud of his *Helix maritima* var. *α* is "*Anfr. infimo fasciis confertis interruptis subtùs notato, et suprà fasciâ unicâ continuatâ.*"

The var. *γ* is described as "*Testâ fasciolis confertis interruptis, aut maculis radiantibus pulchrè perfusâ.*"

The var. **maritima** Drap. is the stunted maritime form, but is not confined to that environment, being found also in the less favourable localities inland. Draparnaud's figures 9 and 10 represent not the type form but his var. *γ*, and show this form as being 11 mill. in diameter and about 10 mill. in altitude.

Fig. 249.

Fig. 250.

Fig. 249, 250.—*X. virgata* v. *maritima* Drap. (*Helix maritima* var. *γ* Drap., after Draparnaud).

According to Comm. Caziot, of Nice, one of the most critical conchologists of the present day, no shell has been more misunderstood by French authors, even Moquin-Tandon and Dupuy are stated to have erroneously figured as this form a shell of the *Xalonica* group. The figures reproduced herewith from Draparnaud of *H. maritima* var. *γ* are the only ones he published to represent his species, and we are now entirely dependent on the descriptions and these figures for our appreciation of its peculiarities, as the actual type specimens have disappeared from his collection now located in Vienna Museum.

The *Helix maritima* is also usually considered to be the *Helix lineata* of Olivi, but this is denied by several French conchologists who have specially studied the question, affirming that Olivi's description is too meagre, and that the six cited illustrations differ somewhat in their characters.

The sub-var. **minor** of Pirona is described as 10–12 mill. in diameter. The sub-var. *variabilis-minor* Bourguignat is 12 mill. in diameter; the *lineata-minor* 8–9 mill.; while the *lauta-minor* and *moesta-minor* are each 11 mill. diameter. The sub-var. *minor* Taylor is 6½ mill. in diameter, and might form a sub-var. **minima.**

The sub-var. **submaritima** Jeffreys is described as much smaller, more deeply coloured (often with a violet tinge), and spire raised. Diam., 8 mill.; alt., 6¼ mill.

The sub-var. **burdigalensis** is stated by Morelet to be a modification of *Helix maritima*, and exactly similar to Algerian specimens of Draparnaud's species.

This variety is diffused along the downs, etc., especially near the sea-coast, and has been observed to have the habit of covering the tips of the short bare grass of the chalk-downs at Freshwater, Isle of Wight, but is not confined to such places. It is similarly distributed throughout Southern and Western Europe, North Africa, and Western Asia.

FOREIGN DISTRIBUTION.

France—The var. *maritima* is recorded from Gard, Hèrault, Loire Inférieure, Manche, and Somme.

The sub-var. *moesta-minor* is recorded from Mentone, Alpes Maritimes.

The sub-var. *burdigalensis* from Cestas near Bordeaux, Gironde.

Italy—The *H. lineata* is recorded from Viareggio, Tuscany; from Venice, Venetia, and from the Island of Sardinia.

The sub-var. *burdigalensis* is recorded from the Island of Lampedusa.

Spain—The var. *maritima* is recorded from Carmona, near Seville, Andalusia, by the Rev. R. Ashington Bullen.

Greece—The var. *maritima* is recorded from Zante, Ionian Islands, by P. Hesse.

Algeria—The *H. moesta* v. *minor* is recorded by Bourguignat from Oued-Kebir, near Blidah, and from Bône, Dellys, Oran, etc.

The sub-var. *lauta-minor* is recorded from Bône.

The sub-var. *variabilis-minor* from Oran.

VARIATIONS IN COLOUR OF SHELL.

Var. **nigrescens** Grateloup.

Helix variabilis var. *nigrescens* Grateloup, Moll. Landes, 1829.

Shell with the whole surface suffused with purple-brown.

[The var. *nigrescens* of Westerlund is not this variety, but a fasciate form with very dark zonulation].

This form is usually more or less segregated, but is also of more or less sporadic distribution. At Yarmouth, Isle of Wight, this variety is chiefly concentrated within the space of a few square yards of sea cliff, where the prevalent plant is *Carduus tenuifolius*, on whose stems and leaves it is found associated with the typical form.

BRITISH DISTRIBUTION.

Devon S.—Beer Head, Nov. 1903 ! F. J. Partridge.
Devon N.—Paddington, 1903 ! F. J. Partridge. Woolacombe, 1910, H. Watson.
Somerset N.—Burnham ! Rev. Canon Norman. Weston-super-Mare, R. Standen.
Dorset—Quarry, Portland, Sept. 1889 ! N. M. Richardson. Poole, C. E. Wright.
Sussex W.—Kingly Vale, Chichester, Rev. W. A. Shaw. Lewes, Mr. Jenner.
Sussex E.—Seaford, A. H. Jowett-Murray. Winchelsea, E. W. Swanton.
Kent W.—Brookland, Aug. 1896, Lionel E. Adams.
Isle of Wight—Freshwater, 1878 ! J. W. Wood. Not uncommon on *Carduus tenuifolius*, Afton Downs ! C. Ashford.
Lincoln N.—On *Brassica rapa*, Cadney ! Rev. E. A. Woodruffe-Peacock.
Yorks. S.E.—Plentiful near the sea, Hornsea, July 1880, J. Darker Butterell. Kilnsea Warren, Spurn, T. Petch.
Yorks. N.E.—Crossgates near Scarborough, Aug. 1889, J. A. Hargreaves.
Carmarthen—Laugharne, Sept. 1883, C. Jeffery. Pendine, G. W. Mellors.
Pembroke — Giltar, St. Catherine's Rock, Jubilee gardens, Ritec gardens, Manorbier, and occasionally on the Burrows at Tenby, A. G. Stubbs.
Wexford—Rosslare sand-bank, Sept. 1889 ! G. Barrett-Hamilton.
Cork—Youghal, Aug. 1902 ! P. H. Grierson.
Kerry S.—Venting, Dingle, R. Welch and A. W. Stelfox.

FOREIGN DISTRIBUTION.

France — Environs of Paris (Pascal); Dax and Le Puoy-du-Hour, Landes (Grateloup). Nîmes, Gard (M. Clement).
Spain—Plentiful but small, Algeçiras, Andalusia (K. H. Jones).

Var. **rufula** Moquin-Tandon.

Helix variabilis var. *rufula* Moquin, Hist. Moll., 1855, p. 263.

Shell nearly uniformly dark rufous.

This variety is probably rare, as there are comparatively few undoubted records.

BRITISH DISTRIBUTION.

Channel Isles—Alderney (Tomlin and Marquand, Journ. of Conch., x, p. 389).
Somerset N.—Near Burnham (Norman, Somerset list, 1861).
Dorset—Wyke-Regis, near Weymouth, August 1886, J. R. le B. Tomlin.
Lancashire S.—Southport, 1915 ! W. J. Farrer.

WALES.

Glamorgan—Limestone cliffs near Cardiff, April 1907 ! H. R. Wakefield.
Pembroke—South Cliff, Tenby, Oct. 1895 ! A. G. Stubbs.

IRELAND.

Dublin—Near Dublin, J. W. Warren ! Alder Collection, Newcastle Museum.

FOREIGN DISTRIBUTION.

France—Recorded for the environs of Paris by M. Pascal; from Durfort, near Sorèze, Tarn, by Moquin-Tandon; and from Nîmes, Gard, by M. Clement.
Algeria—Recorded from Oran by M. Bourguignat.

Var. **lutescens** Moquin-Tandon.

Helix variabilis var. *lutescens* Moq., Hist. Moll., 1855, vol. ii, p. 263.
Helix lineata var. *lutescens* Moq., op. cit., p. 266.
Helix lauta var. *lutescens* Bourguignat, Mal. Alger., 1864, vol. i, p. 223.

Shell uniformly yellowish.

This form, though sometimes associated with other varieties or with the typical form, more usually lives in more or less segregated communities.

Its distribution is practically coincident with that of the typical form, but precise and definite records are very scanty.

BRITISH DISTRIBUTION.

The var. *lutescens* extends over a considerable number of comital divisions in the British Isles.

FOREIGN DISTRIBUTION.

France—It is recorded by M. Pascal from the environs of Paris, and by Dr. Scharff from Bordeaux, Gironde. It has also been found by Dr. W. E. Clarke at Perpignan, Pyrénées Orientales; by Mr. Hugh Watson at Cap Breton in the Landes, and Grasse in the Alpes Maritimes; by Moquin-Tandon from Port Vendres, Alpes Maritimes; and by Mr. F. H. Sikes at Bayeux in Calvados, and Estretat in Seine Inférieure.

Italy—Dr. Arturo Issel has recorded its presence at Perugia, etc., in Umbria, as well as from the Island of Malta.

Spain—It is recorded by Bofill from Barcelona in Catalonia.

Asia Minor—It is recorded by Prof. von Martens from Troas (the ancient Troy), in the province of Broussa, on the authority of Dr. Virchow.

Algeria—M. Bourguignat records it from Oran, Mostaghenem, and other places.

Var. **hyalozona** Moquin-Tandon.

Helix variabilis var. 6 Bouch.-Chant., Moll. Pas de Calais, 1838, p. 35.
Helix variabilis var. *hyalozona* Moquin, Hist. Moll., 1855, vol. ii, p. 263 (not the *hyalozonata* of British authors).
Helix virgata var. *variabilis* f. *hyalozona* Westl., p.p. Faun. Palæarct., 1889, p. 166.

The var. **hyalozona** Moq. is described as yellowish with transparent bands.

The sub-var. **hyalozona** Westerlund is yellowish [or matt-white] with transparent bands, and only in part placed here.

GEOGRAPHICAL DISTRIBUTION.

Neither Moquin-Tandon or Westerlund give any precise references to its range.

France—The var. *hyalozona* Moq. is enumerated for the Pas-de-Calais as var. 6 by M. Bouchard-Chantereaux, and recorded for Nîmes, Gard, by M. Clement.

Var. **albicans** Grateloup.

Helix variabilis var. δ Draparnaud, Tabl. Moll., 1801, p. 73.
Helix variabilis var. *albicans* Grateloup, Moll. Landes, 1829.
Helix variabilis var. *grisea* Bouch.-Chant., Moll. Pas-de-Calais, 1838, p. 35.
Helix variabilis var. *albida* Westl., Faun. Europ., 1878, p. 97, Rossm., Iconog., 1839, f. 356e.
Helix lauta var. *albinos* Bourgt., Mal. Alger., 1864, vol. i, p. 223, pl. 23, ff. 15, 16 & 22.
Helix istriensis (Zgl.) Menke, Syn. Moll. Meth., 1830, p. 23.
Helix variabilis var. *bordighalensis* Reinhardt, S. B. Gesellsch, Nat. Fr., 1886, p. 55.
Helix variabilis var. *albescens* Benoit, Test. estram. Sicily, 1857, p. 126, pl. ii, f. 21d.
Helix virgata var. *variabilis* f. *albicans* Westerlund, Faun. Palæarct., 1889, p. 166.

SHELL almost uniformly whitish, frequently tinged with rufous at the aperture.

This variety is said to be often smaller than the fasciate form found with it, and its characters are probably a result of living under exposed and arid conditions. It has been noted by Rev. E. A. Woodruffe-Peacock and Mr. Hawkins as especially frequenting and feeding upon the black knapweed (*Centaurea nigra*) in Lincolnshire, and at Castle Howard, Yorkshire.

The var. **albicans** Grateloup s.s. is described by Moquin-Tandon as entirely whitish or white.

The var. **albinos** Bourguignat is described as entirely whitish.

The var. **istriensis** Ziegler, described by Menke as "unicolor albida," and the *H. zaraensis* Muhlf. from Zara, Dalmatia, are both probably referable to the var. *albicans* of the present species.

The var. **albida** Westerlund is unicolorous whitish, spire slightly elevated.

The var. **albescens** Benoit is smaller, uniformly whitish, sometimes fasciate, spire somewhat raised, and apertural rib of a rosy red.

The var. **bordighalensis** Reinhardt is described as small, entirely white, and unbanded, but this is not the *Helix burdigalensis* of Grateloup, which is a banded form and belongs the fasciate group.

The var. **grisea** Bouchard-Chantereaux is described by Moquin-Tandon as entirely grey, and I inclined to regard it as merely an extreme and subordinate form of the var. *albicans*.

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